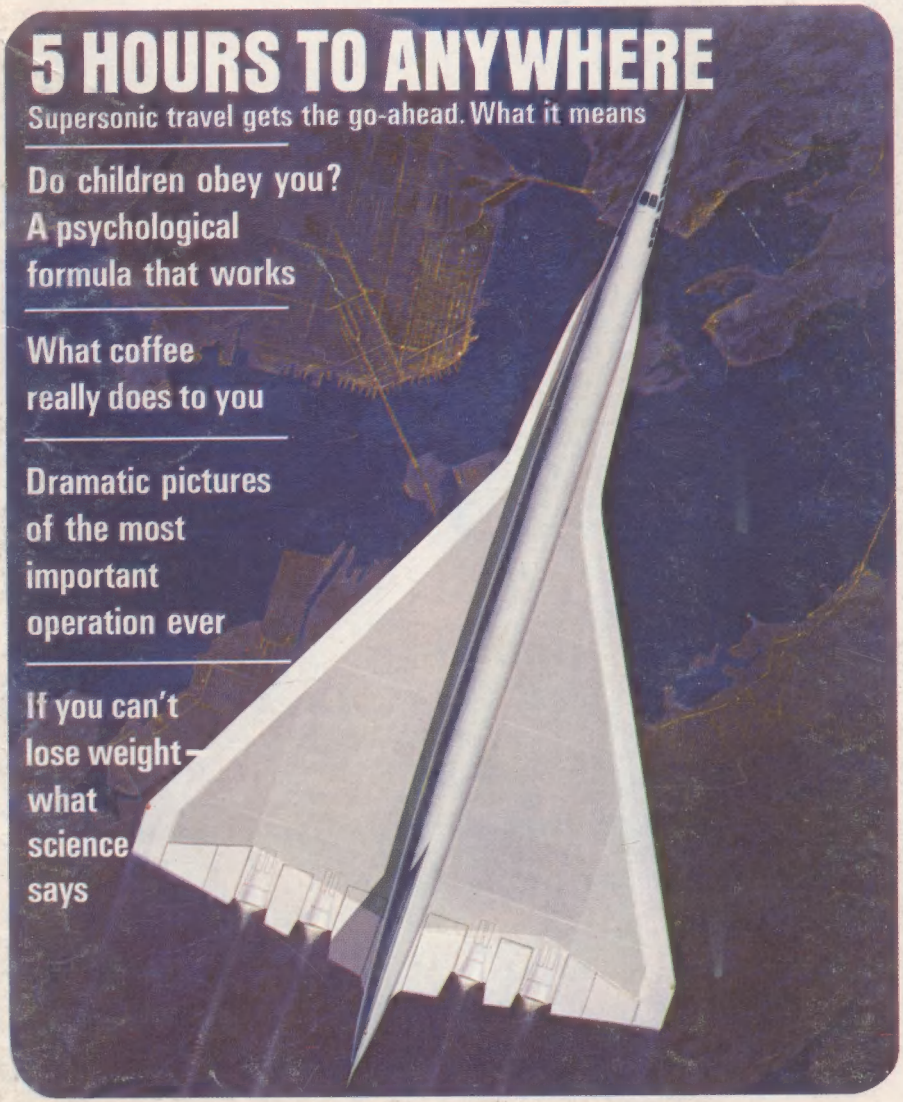
The science news monthly

SCIENCE DIGEST

JULY 1966 50 CENTS ICD



5 HOURS TO ANYWHERE

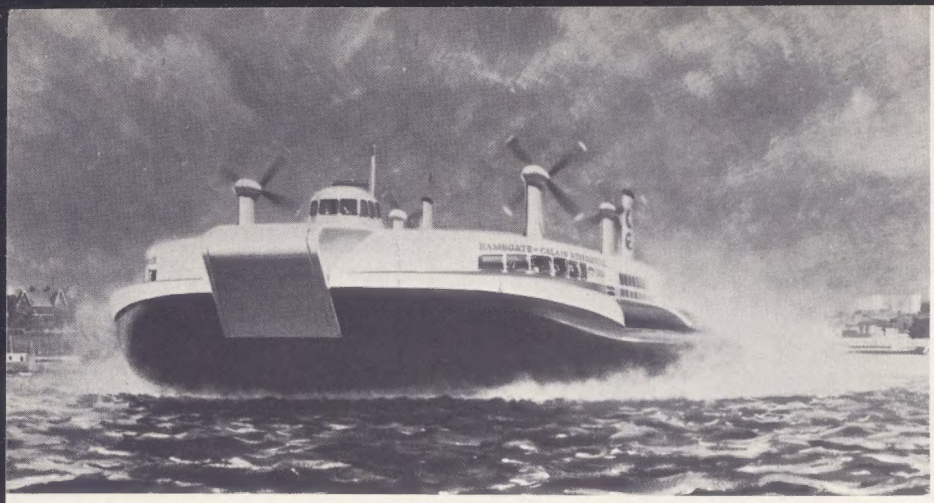
Supersonic travel gets the go-ahead. What it means

Do children obey you? A psychological formula that works

What coffee really does to you

Dramatic pictures of the most important operation ever

If you can't lose weight — what science says



Now—hoverships

By 1968, that nightmare of European travel, a water crossing of the English Channel, should be a briefer, less stomach-churning experience.

That is the year a giant Hovercraft is scheduled to begin Channel service between England and France. The craft, the 150-ton SRN-IV, will carry up to 500 passengers across the Channel in about 20 minutes.

A scaled-down working model of this monster among air cushion vehicles (above) was shown in June at "Hovershow Sixty-Six," the first large-scale exhibition devoted entirely to Hovercraft. The show was presented by the recently formed British Hovercraft Association, whose members include the main Hovercraft manufacturers and allied companies.

The British have taken the lead in the development of this form of transportation. There are several regular Hoverferry services operating in the British Isles (including a small one shuttling across the Channel). As yet, they are limited and the Hovercraft is still regarded as a novelty vehicle. But the manufacturers hope that the first Hovershow will stimulate widespread, regular use of the unusual craft.

The Channel ferry is the most ambitious Hovercraft plan now in the works. Even the most enthusiastic Hovercraft boosters do not think it will replace present ship and plane transportation, but it is hoped that Hovercraft will be used to help handle increasingly heavy short-haul traffic. Developers believe that a Hoverferry could make 14 round-trips between Dover and Calais in an 18-hour working day, including loading and unloading.

Developers also look toward the day when Hoverferries will be used in the Mediterranean, in the archipelago of Greece and in Scandinavia.

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WOULD you like to know who's reading this issue of *Science Digest* besides yourself?

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A New York City woman in her sixties who subscribed to the magazine for her grandchildren when

THIS MONTH

they were in high school and college and got hooked herself.

A member of the faculty of the Air War College who wanted permission to reprint an article as required reading for its students.

A lad in elementary school who wanted the answers to a couple of tricky astronomy questions.

An M.D. who wanted some reprints of a medical article.

An industrialist who wanted to contact the manufacturer of a new product we reported.

To *Science Digest* readers, science isn't a forbidding lab or an incomprehensible formula. It's what the word itself means: knowledge; new, systematized knowledge; knowledge with a practical, fascinating application to their daily lives. They want to know what is important to know about themselves and the vast universe.

In science, we say, today is already yesterday; tomorrow is already here. Our aim is to keep you, like science, one jump ahead.

—THE EDITORS

The science news monthly

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DIGEST

You'll ride at 1,800 mph in the upper reaches of the atmosphere when the supersonic transport becomes a reality. Here's Lockheed's view of what it will look like. For the story of this aviation revolution, turn to page 60.
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THE LATE SCIENCE NEWS

CHINA NEARS THE H-BOMB. China's third atomic test was not that of a hydrogen weapon. But it is getting close. Said the U.S. Atomic Energy Commission, "The test was probably an experimental device, either attempting to increase the yield of the previous low-yield fission device or looking toward an eventual thermonuclear (hydrogen) capability." The first Chinese test of an H-weapon may come as early as this fall. A chilling fact that emerges is the speed with which the Chinese have advanced toward a thermonuclear capability. It took the U.S. seven years to develop from the first fission experiment to a thermonuclear explosion. With U.S. aid, the British did it in five years. The Russians took only four. It may take the Chinese a little over two years. And, compared to the others, China is a technologically backward nation.

SPACE DOGS TROUBLES. The two Soviet dogs that spent 22 days in orbit earlier this year suffered some functional changes that may have ominous implications for prolonged manned spaceflight. Russian space medicine experts reported that during their long period of weightlessness, the dogs had suffered muscular reduction, dehydration, loss of calcium and a confusion in readjusting to walking. The dogs did not return to normal until some days after landing. The Russians noted that a really long weightless period might make a return to the earth's gravity impossible.

MANEUVERABLE PARACHUTE. A parachute-like flexible wing is being tested by the Army for possible use as a maneuverable glide-parachute (above). Although it looks as if it was designed by Batman, the device is an adaptation of the concept of a flexible wing originated by NASA scientist Francis M. Rogallo in 1948. The parawing can be steered over moderate distances to a pin-point landing at a preselected site.

ASTRONAUT RESCUE PLANS. NASA is investigating a wide variety of emergency escape systems for space. One of the most novel is a tank of plastic foam that would form a rigid structure around the astronaut. Re-entry would be accomplished with a hand-held rocket, the foam serving as protection.

PECULIAR VENUS. Venus, the lone retrograde or backward spinner among the planets, is rotating clockwise only once in 243 days. What is more, a NASA report revealed, it always turns the same face toward Earth as it passes this planet, indicating that our gravity somehow influences the rotation of Venus. . . . .Recent radar studies of Venus indicate that the planet, formerly believed to be smooth, may have rough areas, even mountain ranges. . . .Scientists at Johns Hopkins University, who have long held the minority opinion that Venus is cool enough to support life, have offered new microwave studies of the planet to support their "life on Venus" theories.

'SEASONS' ON MARS. New studies of Mars suggest that the seasonal contrast changes so often attributed to the growth of springtime vegetation may actually be caused by windblown dust on the planet's surface. Two Smithsonian Astrophysical Observatory scientists offered this inorganic explanation after photographs from earth-orbiting satellites showed that springtime vegetation changes were difficult to detect even on our own planet. They point out that different sized particles of dust could account for the differences between light and dark areas on Mars, and that spring winds could rearrange the dust.

SUN'S X-RAYS. Solar X-ray emissions have been rising sharply in past months. This may indicate that the coming peak in sunspot activity may be the most intense on record. Periods of maximum sunspot activity seem to occur in 11-year cycles.

GAMMA RAY PUZZLE. An object that lies near the constellation Cygnus is emitting gamma rays, U. of Rochester scientists report. It is the first source of such radiation ever discovered, and there is no explanation for the unexpected phenomenon.

POOR MOHOLE. A House committee cut all funds for Project Mohole. Thus, the ambitious plan to drill through the earth's crust, which has been in trouble almost from the beginning, is in worse trouble than ever. President Johnson made an appeal to Congress to restore funds for Mohole, but its future remained in doubt. Mohole may become another casualty of the high cost of the war in Vietnam.

UNDERGROUND BLAST. An underground nuclear explosion in the Aleutian Islands last year did a number of things it shouldn't have. For one thing, it threw lakes and ponds 100 feet or more in the air. For another, it showed that tremors created by the blast travelled much more quickly than expected and were clearly different from those of natural quakes in the same region. The difference was considered very important because it relates to the ability to detect secret underground nuclear tests.

BALL LIGHTNING. Two Westinghouse scientists believe they have theoretically proved the existence of ball lightning--even though it has never been produced in the laboratory. For years, scientists were skeptical about ball lightning, but the number of credible people who reported seeing it made many take the alleged phenomena more seriously.

THE NEW PILL. A contraceptive pill that works even when taken days after conception occurs may soon be a realtiy. At least two teams of scientists are well along in research on a pill that will prevent a fertilized egg from becoming implanted in the uterus. How the pill actually works is unknown, but extensive animal and limited human tests show that it does indeed work. When will the new pill become available? Estimates range from two to four years.

END TO DWARFISM? Using a human growth hormone, doctors have been remarkably successful in treating dwarfism. Unfortunately, the natural hormone is too rare for use in any extensive treatment program. However, scientists have now determined the complete chemical structure of the hormone, and this may pave the way for the manufacture of an artificial growth hormone. The hormone may also have other uses, but because of its extreme scarcity, experiments with it have been very limited. A team headed by Dr. C.H. Li of the University of California achieved the complex chemical analysis of the hormone's structure.

QUOTE OF THE MONTH: "It is all too evident that science is not self-sufficient, cannot be an end in itself. Science is made by man for man; it must therefore come out of the sphere of its research and reflect on man and through man on human society and universal history. . . .The faithful scientist cannot, confronted with the conconsequences of his discovery, ignore the complex being that is, in the last analysis, the human person." --POPE PAUL VI.

THE SPACE PICTURE

18 days on the moon

AFTER spending 18 days in an area about the volume of three telephone booths, two volunteers emerged in better physical condition than when they began.

The two were engineers of the NASA Marshall Space Flight Center. They were testing conditions in a simulated lunar-surface shelter vehicle which had a free volume of living-working space totalling only 115 cubic inches. They were in the compartment all the time except for occasional brief periods of "extravehicular activity."

The experiment was designed to duplicate as nearly as possible the activities of two astronauts who had landed on the moon to conduct a 14 to 21 day exploration mission.

Michael J. Vaccaro, acting as the flight commander, and Haydon Y. Grubbs followed a daily routine and performed assigned tasks until receiving instructions from outside 18 days later to cease all activity and leave the cabin because the experiment was at an end.

Neither man knew upon entering the simulator exactly when the test would terminate. This was done to avoid "end spurt," a quickening of pace to finish tasks faster than normal as exit time neared.

During the test, the men were cut off from the outside world as they would have been had they actually been on the moon. Their only link was by radio.

Engineer Michael J. Vaccaro operates driving controls of a "lunar vehicle" during an 18-day stay in a tiny cabin.

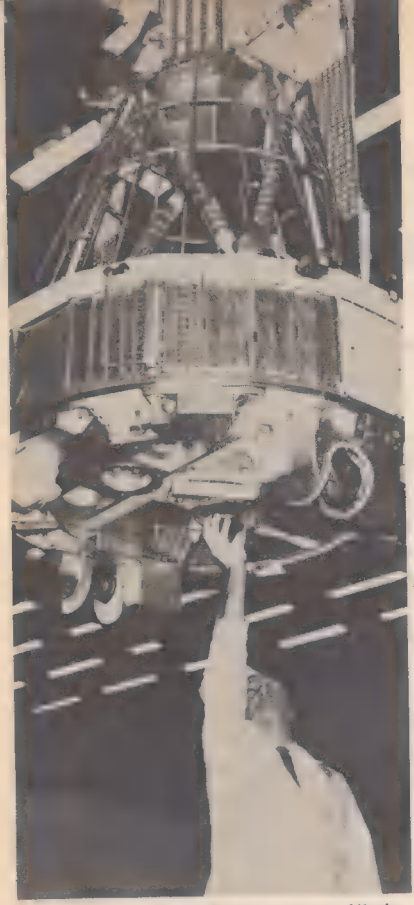
The two men proved that they could cope with "space emergencies." Four "emergencies" were planned by the experimenters and sprung on the test subjects unexpectedly.

Perhaps one of the most important by-products of the test was the confirmation that in such a mission no scheduled exercise periods inside the vehicle are necessary to maintain physical fitness.

The subjects were "good friends" when the mission started and remained that way. "Arguments and disagreements were out of the question," said Vaccaro.

Deep-dish space tracking

Right: The new 210 foot-diameter tracking and communication antenna near Goldstone, Calif., is world's most powerful. Below: Dish antenna's receiving and transmitting equipment is powerful enough to reach a craft at the solar system's edge.

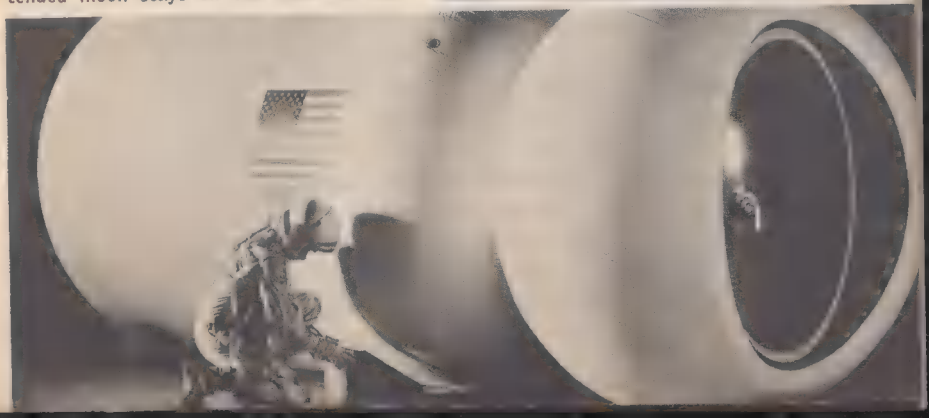


Technician makes adjustment on Nimbus spacecraft, the nation's most advanced weather satellite. Craft is able to automatically take nighttime infrared pictures.

Space-garbed technician adjusts block under prototype of a proposed model of a moon shelter which may be used for extended moon stays on the lunar surface.

Engineer takes his own TV picture with system being built to transmit views of rocket engine operation from 40 miles up.

Astronauts Thomas P. Stafford, left, and Eugene A. Cernan. Their Gemini 9 mission was delayed by Agena target explosion.



Fatherhood in deep freeze

University of Michigan researcher Dr. S. J. Behrman has announced revolutionary advances in the use of frozen human sperm.

by Hugh Wray-McCann

ABOUT one year ago, the curiosity of the scientific world was stirred by the proposal of a Highland Park College (Michigan) science teacher, Robert C. Ettinger, that persons about to die from incurable diseases be frozen at the point of death—and thawed out years later when treatment for the "incurable" disease is available. Now, at the opposite end of the spectrum of life, comes news of dramatic possibilities in the use of the deep-freeze technique.

Before an April meeting of the Michigan Society of Obstetricians and Gynecologists, University of Michigan researcher Dr. S. J. Behrman, director of the Center for Research in Reproductive Biology, announced that 17 healthy, happy babies had been born from mothers impregnated with sperm frozen as long as two and a half years ago.

"What we have done so far," explains Behrman, "is to freeze the male cell through which life has been passed on over the centuries. We are able to suspend this life up to two and a half years and still obtain successful pregnancies. There is every reason to believe at the moment that this suspension can be prolonged indefinitely."

At present, some U.S. fertility clinics are storing sperm in liquid-nitrogen deep freezes; a few of them have reported successful conception and delivery from six-to-eight-month-old sperm—but none has equaled Behrman's two and a half years.

Immediately benefited are men with few or weak sperm and men who are about to undergo surgery which may destroy their reproductive capacity.

The ejaculate of the normal male is about 3 or 4 cc and contains between 350 and 400 million sperm. The oligospermic (weak-spermed)

male averages less than 10 million sperm per cubic milliliter and his chances of becoming a father are low. To boost his chances, Behrman collects eight ejaculates over a period, separates the strong from the weak sperm by centrifuge, thus producing the ejaculate equivalent of a highly fertile man. The eight collections may be made over a period, so each is frozen until the wife is ready for insemination.

For the victim of a prostate operation or bladder-cancer surgery, says Behrman, "we can collect his sperm ahead of time and store it —apparently indefinitely—in the event children are desired later."

Sperm banks

The ultimate significance, as Behrman sees it, is that "for those who fit all the physical and especially psychological qualifications for artificial insemination, we could have frozen sperm available in banks like skin banks. If and when the whole idea becomes more socially acceptable, I foresee the day when it will be possible for a doctor in some remote area to call up and draw on some central sperm bank for one of his patient couples."

And the ultimate-ultimate significance: It may be the answer to those medical researchers and geneticists who are charged with the responsibility of ensuring that the human race survives possible annihilation in a nuclear holocaust.

Behrman, a precise-speaking M.D. from Capetown, South Africa, and a University of Michigan faculty member since 1950, has been studying artificial insemination for 15 years. His work is sponsored by the Ford Foundation and the National Institute of Human Development. During this time, he has induced over 400 pregnancies using freshly donated sperm. Only in the past three years has he experimented with frozen sperm. In this work, he has inseminated 114 women and obtained 28 pregnancies. From these, there were 17 live births, 5 spontaneous abortions, 1 ectopic (abnormally placed) pregnancy (terminated); 5 pregnancies are still continuing. All 17 babies have been regularly examined since birth and show no defects traceable to the freezing of the sperm.

Freezing sperm—without killing it—is much more difficult than it might appear. The sperm used in the first 11 pregnancies had been frozen with dry ice. The freezing rate of dry ice cannot be controlled. When the sperm's temperature dropped, it began to crystallize. At the point of crystallization, it gave off heat (heat of crystallization). This heat damaged many of the sperm. This accounts for the comparatively low pregnancy rate: in the first 70 inseminations there were only 11 pregnancies. Some means had to be found of passing through that crystallization zone, with its sperm-damaging heat, at a rate that could be controlled. Behrman turned to liquid nitrogen. The pregnancy rate shows the decided advantage of liquid-nitrogen freez-

ing: in 44 inseminations, 17 pregnancies.

Freezing is only part of the process, which goes this way: Behrman collects what he calls a "split ejaculate." The first half of an ejaculate is richer in sperm than the second half. Collecting it in halves is an automatic method of concentrating it. The first half is placed in a centrifuge. Interestingly, it is not a case of the stronger sperm's being spun to the outside of the centrifuge, leaving the weaker inside, or vice versa. The physical agitation merely destroys the weaker sperm, leaving the stronger sperm unharmed. Next it is mixed with an equal measure of protective medium (chiefly egg yolk and glycerol). The liquid nitrogen reduces the mixture to minus 196.5° C. in 20 minutes.

The customary insemination dose is 1 cc of the mixture (50 to 100 million sperm). Placed in a glass vial, it thaws out after five minutes in water at 37°C.

The idea of using frozen sperm is comparatively new in the area of human genetics. Less than a half dozen laboratories around the world are currently engaged in it, but in animal breeding it is not new. The breakthrough achieved by Behrman, research associate Donald Ackerman and visiting scientist Yoshiaki Sawada (M.D.), from the Central Laboratories for Experimental Animals in Tokyo, is in the liquid-nitrogen freezing technique. It means, explains Behrman, that "for the first time we are able to study sperm in detail over weeks and months. Even the healthiest sperm is dead and lost to study in about 24 hours if it is not frozen.

Because of sperm's very short life, a great deal remains to be found out about its behavior. Already, however, with the longevity provided by freezing, Behrman has been able to come up with something new:

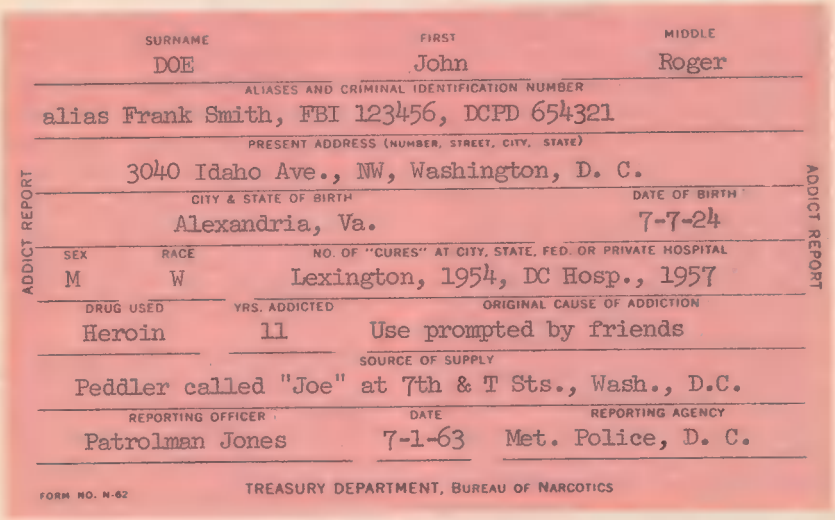
"We have learned that the metabolism of sperm—its ability to use oxygen—is a much more important index of fertilizing capacity than is the amount of sperm. Perhaps some day we may find out how to improve the metabolism of weak sperm."

The liquid-nitrogen freezing technique has demonstrated its superiority over the dry-ice freezing technique: 41 percent of attempts to induce pregnancy were successful as contrasted with 16 percent; however, Behrman is careful to point out that the work is still in its preliminary phases.

Despite his success, Behrman has had to inhibit the futuristic thinking of some enthusiasts.

"The day when we can preserve the sperm, the life cells, of an Einstein or a Beethoven for reproduction in future centuries is still a long way off. Someday it should be possible to identify the chromosomes responsible for certain characteristics and produce a child with exactly the characteristics desired. But that won't be tomorrow. Maybe it can be done by the 21st century."

New hope for drug addicts



ADDICT REPORT

SURNAME	FIRST	MIDDLE
DOE	John	Roger

ALIASES AND CRIMINAL IDENTIFICATION NUMBER
alias Frank Smith, FBI 123456, DCPD 654321

PRESENT ADDRESS (NUMBER, STREET, CITY, STATE)
3040 Idaho Ave., NW, Washington, D. C.

CITY & STATE OF BIRTH	DATE OF BIRTH
Alexandria, Va.	7-7-24

SEX	RACE	NO. OF "CURES" AT CITY, STATE, FED. OR PRIVATE HOSPITAL
M	W	Lexington, 1954, DC Hosp., 1957

DRUG USED	YRS. ADDICTED	ORIGINAL CAUSE OF ADDICTION
Heroin	11	Use prompted by friends

SOURCE OF SUPPLY
Peddler called "Joe" at 7th & T Sts., Wash., D.C.

REPORTING OFFICER	DATE	REPORTING AGENCY
Patrolman Jones	7-1-63	Met. Police, D. C.

FORM NO. N-62 TREASURY DEPARTMENT, BUREAU OF NARCOTICS

ADDICT REPORT

by Flora Rheta Schreiber and Melvin Herman

THIRTY out of 100 drug addicts first admitted to the Lexington United States Public Health Service Hospital in 1952-3 have found to be free of their addiction 12 years later.

Dr. George B. Vaillant, research fellow in pharmacology, Harvard Medical School, has kept watch over these 100 addicts from Lexington, chronic and recovered, in a detailed 12-year-follow-up study. He is optimistic.

"The addict can and does become a useful member of society," he said. All 30 have abstained from drugs for at least three years. They have been free of convictions for at least four years. The group as a whole was drug-free for an average of almost eight years. Morever, 18 are married and responsibly supporting their families.

On what does recovery depend? "More than anything else," says Dr. Vaillant, "upon the addict's receiving compulsory supervision and upon his discovering gratifying alternatives."

This finding challenges the accepted belief that addicts cannot break free of their addiction.

The finding is the more noteworthy because there are few reliable studies of the "ex-addict" by

psychiatrists. It has been difficult to study "ex-addicts" since they rarely present themselves in the private office of a psychiatrist or in a psychiatric clinic.

Dr. Vaillant and his researchers compared the 30 "ex-addicts" with 30 chronic addicts from among the original 100 men who had entered Lexington together.

Dr. Vaillant's team also investigated two common hypotheses: (1) Do addicts "mature" out of addiction, or (2) do they, in lieu of their addiction, develop psychosomatic illnesses or depressions?

Significantly, the new data proved these hypotheses to be false.

The "ex-addicts" neither matured on the one hand nor developed illnesses or depressions on the other. Instead, 63 percent of these men found support in good, working, new relationships with persons other than blood relatives. Compulsory supervision helped turn the tide for 40 percent. Interestingly, though it is generally alleged that bad environment is a spur to drug addiction, 70 percent were able to break free of addiction even though they continued to live in high drug-use communities.

The personality traits "ex-addicts" have in common bear scrutiny. Even though they continue to be immature and dependent upon others, they exhibit very little crippling psychopathology.

Their backgrounds do not differ from those of the men who continue as addicts. The ethnic groups are the same. So are the anti-social histories and the degree of original narcotic use.

Three notable differences, however, did emerge. The ex-addicts had better employment records before they entered Lexington than did the chronic addicts. The ex-addicts also had more stable early childhoods than did the chronic addicts and the ex-addicts had become addicted later in life than did the permanent addict.

Accidental addicts

DESPITE the Harvard study just discussed, drugs continue to be an increasing menace to both the obvious addict and the man who merely flirts with drugs.

The flirtation is swiftly becoming an uninhibited one. Young adults illegally take amphetamines for "kicks." Mature adults have contracted the habit after having a physician prescribe it for exhaustion or as an appetite suppressant. And the flirtation grows into an addiction.

"Excessive amphetamine consumption can produce permanent organic damage to the brain," Dr. Frederick Lemere, clinical professor of psychiatry, University of Seattle, Washington, and medical director of Firlawn Sanitarium, Kenmore, Washington, recently told the American Psychiatric Association. "Clinical, pathological and

Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

experimental studies have shown this to be true. But the public still does not seem aware of the actual damage amphetamine dependency can cause."

Too many pills, Dr. Lemere also maintains, cause nervousness, restlessness, irritability, aggressiveness, violence, insomnia, weight loss and emotional instability. The doctor warns, too, that amphetamine dependency can result in psychoses similar to schizophrenia or sometimes manic-depressive reactions.

There are grim warnings from Japan, where amphetamine dependency has been at its highest. There, during and after World War II, the drug was readily available on a non-prescription basis. The result was that 12 years ago the country had, conservatively estimated, 200,000 amphetamine addicts. However, when the government imposed strict controls over the distribution of the drugs, the number of addicts sharply declined.

The Japanese experience makes one thing clear. Amphetamine should be prescribed only under the strictest medical supervision. Of 131 hospitalized addicts, only one-half recovered from psychoses within six months of withdrawal. Fourteen percent developed chronic psychoses which persisted as long as 15 years after hospitalization.

Newlywed troubles

WHEN Wells Goodrich, M.D., Chief, Child Research Branch, National Institute of Mental Health, Bethesda, Maryland, and Robert G. Ryder, Phd., Chief, Section on Family Development of the same institution, made an intensive study of 49 middle-class couples in their fourth month of marriage, four distinct marriage syndromes emerged.

One syndrome is the "husband-ambitiousness" pattern. Here the husband is driven to get ahead in his career, but shows self-restraint in his personal relationships, while the wife has little interest in her husband's career. The husband is the undisputed leader and the wife, though submissive, is highly spontaneous. The researchers attribute this syndrome to the husband's dissatisfaction with his own original family background.

A second syndrome is the "couple" pattern. Husband and wife have acquired a strong identity as couples rather than as individuals who are married. Their social activities tend to be with other couples rather than with individuals. Husband and wife are serious and taciturn with each other. Wives deny any unhappiness or doubts about their marriages. The researchers believe that this pattern of family cohesiveness usually occurs when the husband lived with his parents until the time of marriage. Even during the newlywed period, the couple continues to maintain close ties with the husband's family.

The third syndrome is described as "wife rebelliousness." The wife is typically volatile, laughs a great deal, shows little self-restraint and

constantly expresses disapproval. This pattern is said to grow out of present and past difficulties with the wife's family and results in little contact with that family since marriage.

The fourth syndrome, that of "general complaint," revolves around complaints about friends, relatives, housekeeping and the marital sexual relationship. The researchers regard such marriages as essentially poorer than the other three. They concede, however, that any one of the others can also give rise to special difficulties.

Sick adolescents

THE assumption that adolescense is a phase, a normally troubled time from which all adolescents will just naturally emerge triumphant and unimpaired, is dangerous, according to Dr. James F. Masterson, Jr., associate professor of clinical psychiatry, Payne Whitney Psychiatric Clinic, New York.

After studying 72 sick adolescents for five years, the doctor concludes that "growing out of adolescence" applies only to selected cases. A teenager with serious psychiatric problems—schizophrenia and personality disorders—will not outgrow them. Teenagers, with other pathological conditions, who do improve, do so not by resolving conflicts, but by discovering ways of dealing with those conflicts, ways that enable them to function better. The better functioning, however, does not protect them against future stress to which, because of their adolescent conflicts, they are especially vulnerable.

Lesson: The pervasive, often implicit, "grow-out-of-it theory" must be overcome.

Drop-out data

NOT all college drop-outs are out permanently. A University of Illinois research team, conducting a controlled study of 50 college students with difficulties of adjustment and 50 with no extreme adjustment problems, concluded that even those with adjustment problems showed every evidence of eventually finding themselves.

The maladjustment might lead temporarily to following eccentric leaders and ideas and to a frustrating mixture of insecurity, inconsistency and defiance. It also might lead to students' changing schools or courses and even getting on academic probation and dropping out.

But in the end, the adjustment problems tend to right themselves and there is little difference between the drop-out and the student who completed his college work. What this group requires, the researchers say, is tolerance, patience and optimism.

Soviet psychiatry

IS IT unusual for a psychiatrist to see a patient who casually drops in without an appointment? Not in Russia, reports Isidore Zifferstein, M.D., research psychiatrist

of the Psychiatric and Psychosomatic Research Institute of Los Angeles, who spent 13 months in Leningrad, observing Soviet psychiatrists at work.

The Soviet psychiatrist's watchwords are availability and activity. He gives his patient a very active kind of emotional support and reassurance, advice and guidance. He also plays an active role in manipulating the patient's environment. For example, one Soviet psychiatrist, deciding that his patient, a factory worker, would be happier enrolled in an engineering institute, made contact with the factory-director and recommended that the patient be paid his full salary during the entire period of his schooling. The recommendation was followed.

The chief reason for the Soviet psychotherapist's activity and directness is that he carries into his professional work the values and attitudes in which he was reared. As a child, he was taught to function as a member of a collective. He grew up with slogans like "You are not alone in the world" and "Never be a bystander." He feels impelled, if he knows something that another citizen does not, to impart that knowledge to the other.

As a professional, the psychiatrist continues, too, to work as a member of a collective, either on the staff of an out-patient or in-patient institution. He also is dependent on a whole series of social-legislation regulations which he regards as forms of non-specific, anxiety-reducing, public-health measures. He considers himself, and his work, as an integral part of the overall social effort.

Study in rescue

YESTERDAY most problem youths from deprived backgrounds belonged to a group that classical child guidance had largely failed. Their behavior problems and learning difficulties defied the help of orthodox clinics. Today, however, thanks to an imaginative experiment in Washington, D.C., sponsored by Howard University, not only have they been properly treated, but they also have helped others.

The Howard University experimenters chose at random nine ghetto youths between 16 and 21, who were out of school, out of work and seriously disturbed. Instead of being treated in a clinic, they were given nine months of intensive training as mental health aides by a professional staff. They studied such subjects as activity-therapeutic techniques and group dynamics. After the completion of their training they were employed at the Baker's Dozen Community Mental Health Center. Under the close supervision of the Center's professional staff, they led a group-and activity-oriented treatment program. So successful was their performance and their own return to mental health that researchers concluded that such youths can be trained and employed to work effectively.

THE ASTRONOMY STORY

Science's most sophisticated task ever

by Jeff Colvin

When the National Aeronautics and Space Administration had its budget cut recently, the principal victim was the Orbiting Solar Observatory.

But the decision came too late to alter the fact that the OSO Project is the most sophisticated scientific endeavor in history. Two Orbiting Solar Observatories, or OSO's, have already been launched, and four others are already in the development or testing stage and scheduled for launch between now and 1968.

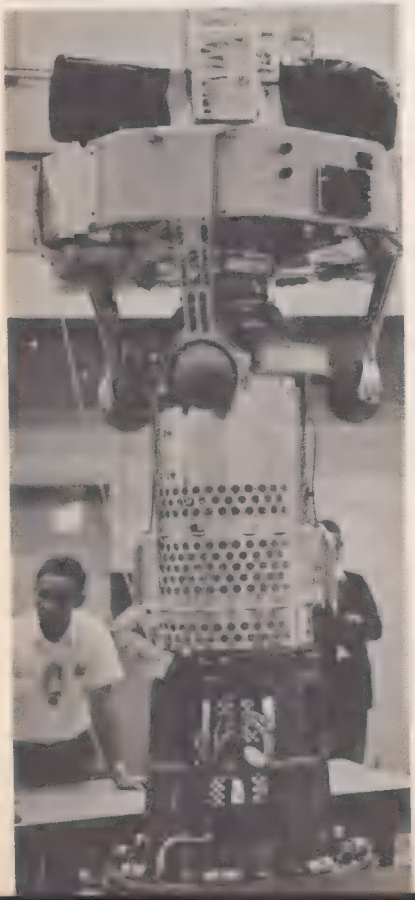
The observatory is a satellite designed to carry instruments above the earth's atmosphere to study radiation and particles from the sun and their interactions with the earth's atmosphere.

According to NASA's Associate Administrator Homer E. Newell, we can "understand the significance of space studies if we remember that the earth is a body immersed in the sun's atmosphere." Fluctuations in the sun's atmosphere produce the daily movement of earthly weather systems. Also, the sun is the only star close enough to us to permit a good look at the fine details of stellar surface features and atmosphere.

Such information is invaluable to the astronomer and the physicist in constructing an adequate theoretical model of a star's structure, and in determining how stars serve as the basic building blocks of the universe.

The OSO satellite itself is basically a "wheel" 44 inches in diameter which rotates for stability. The axis about which the wheel rotates is always oriented at right angles to the direction of the sun, so that the instruments housed in some of the nine separate compartments in the wheel sweep across the sun with every revolution of the wheel. Gas jets keep the wheel rotating at a steady rate of 30 revolutions per minute, so each instrument scans the sun's disc every two seconds. Three arms extend from the wheel's circumference at intervals of 120 degrees to provide rotational stability. At the ends of the arms are six-inch diameter spheres containing the nitrogen gas which supplies the gas jets.

Five of the nine pie-shaped compartments in the wheel structure contain the scientific instruments for the experiments. The other four house the electronic controls, the batteries and the data storage and communications systems. The OSO is the first American satellite to use a data storage and retrieval system:



data are collected and stored during the entire satellite orbit, and then played back to a ground station during a five minute interval while the satellite is overhead. This eliminates the necessity of constant monitoring.

Above the wheel structure is mounted a semi-circular "sail." The sail is covered with nearly 2000 solar cells which convert sunlight into electricity to power the instruments on board. A motor mounted in the sail drives it in a direction opposite to that of the wheel so that it maintains the same face to the sun at all times. This represents an engineering breakthrough; it was the first time moving parts requiring lubrication—such as the bearings and slip rings in a motor—were adapted to operate in the vacuum of space.

The primary solar experiments are mounted in the sail structure. They point continuously at the sun and can scan the sun's face accurately.

The OSO Project was launched successfully with OSO-I on March 7, 1962. OSO-I carried thirteen experiments designed by scientists from various universities and from NASA's Ames Research Center in California and Goddard Space Flight Center in Maryland. The experiments measured solar radiation in gamma ray, X-ray, and

Top: In orbit, the OSO rotates at the rate of 30 times a minute to gain stability. Left: Before launch, OSO's three "arms" ending in gas-containing spheres are folded down. In space, "arms" are extended, nitrogen gas supplies power for rotation jets.

ultra-violet portions of the radiation spectrum, over a wide range of energies. All of these radiations are screened out by different layers of the earth's atmosphere, so they cannot be measured from the earth's surface. From the satellite, scientists learned that there are extremely rapid fluctuations in the X rays from the sun. These changes always follow a period of solar flare activity. OSO-I observed more than 140 solar flares and sub-flares during its six months of measurement. Flares are sudden flashes of light in the neighborhood of sunspots.

Gauges particle fluxes

OSO-I found a wide discrepancy between solar activity above the earth's atmosphere and similar measurements on earth. However, the observatory's measurements also revealed a correlation between the temperature of the upper atmosphere and the intensity of the ultraviolet radiations from the sun.

The solar satellite also carried instruments to measure particle fluxes—electrons, protons and neutrons emitted from the sun. The flux of these elementary particles was also found to undergo wide and rapid variations with the cycle of solar flare activity. OSO-I counted the number of dust particles in the space between earth and sun.

The vehicle was a great success. Altogether about 2000 hours of data were transmitted during a useful lifetime of some six months in orbit.

OSO's will watch, send back data on half of the sun's 11-year cycle.

These accomplishments were momentarily overshadowed in 1964, by the tragedy of OSO-II. Originally scheduled for launch that April, the spacecraft was being mated to the third stage of the Delta launch rocket when the solid fuel rocket accidently ignited. Three technicians were killed, thirteen others injured in the premature blast-off, and the satellite itself was seriously damaged. OSO-II was finally launched successfully on February 3, 1965. OSO-II's performance exceeded expectations. It collected data for over nine months and completed more than 4100 orbits before being "turned off" by ground controllers last November. This action became necessary when the gas supply in the satellite's stabilizers ran out, so the spacecraft could no longer orient itself with the sun.

The wealth of data sent back to earth by OSO-II is still being sorted and analyzed, a process of considerable complexity. The magnetic data tapes must be edited to weed out faulty data and momentary losses of transmission. The raw data must then be correlated with the times they were gathered, where the instrument was pointed at the time, its altitude and position in space. First definitive results from OSO-II may be published later this year.

The OSO Project suffered a further time setback with the launching of OSO-C, the third observatory in the series. The launch itself last August 25 was perfect, but a malfunction in the rocket's third stage prevented the satellite from achieving orbit. There then followed a period of schedule shuffling at Goddard Space Flight Center, supervisor for the project. OSO-D, the next observatory in line, was pushed back to allow OSO-E to fly in place of the lost OSO-C.

OSO-E was scheduled to begin work in June. It is the most sophisticated scientific satellite ever orbited by the United States. In addition to the nitrogen gas jets is a magnetic coil which reacts with the earth's magnetic field to orient the observatory. Operated by ground commands, it is expected to increase the useful lifetime of the satellite.

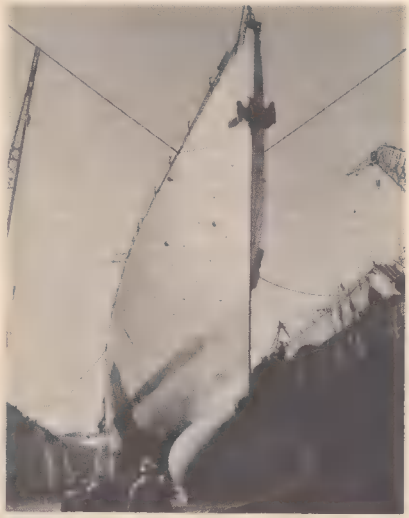
After OSO-D, scheduled for launch late this year, two other observatories will close out the OSO Project by the summer of 1968. All six spacecraft will then have observed more than half of a complete cycle of solar activity. The sun's cycle of activity is approximately eleven years from sunspot maximum back to sunspot maximum, which again occurs in 1969. Sunspot maximum corresponds to an increased outpouring of radiation and elementary particles.

The achievements of the Orbiting Solar Observatories give man a staggering sum of new and valuable information about the solar system in which we live.

"You'll find its just as easy to imagine you're well, as it is to imagine you're sick."

INVENTIONS PATENTS PROCESSES

Rubber-nosed ship



With a rubber dome grafted onto its bow, the destroyer is prepared for sea duty.

FRESH from "plastic surgery" received at the naval shipyard in Boston, Mass., the U.S. Navy destroyer Willis A. Lee is going to sea with a Durante-like rubber nose.

The nose is actually a giant rubber sonar dome that houses and protects sensitive submarine-detection equipment installed at the ship's bow, below the water line.

Designed by B. F. Goodrich, the dome is made of special reinforced rubber that has acoustical properties similar to sea water, permitting sound to pass through with minimum distortion for pickup by sonar gear. Twenty feet wide, 10 feet high and 37 feet long, the dome weighs 19,000 pounds. The inch-thick rubber walls, strengthened with cable reinforcement, are capable of withstanding over 11,500 pounds of pressure per square foot.

It is pressurized internally with sea water to withstand the punishment of high speeds and the hydrodynamic forces of the sea under extreme conditions. The dome is streamlined to reduce water turbulence around the housing.

TV inside you

Television may soon expose the inner man. A TV camera connected to a cystoscope and using a special fiberoptic illuminating system would permit an entire class of medical students to look inside a functioning human organ.

Research to develop the device was announced recently by Dr. John K. Lattimer, chairman of the Dept. of Urology at the Columbia University College of Physicians and Surgeons.

The use of television with a cystoscope would be made possible by binding together approximately 200,000 fiberoptic rods (See "The Light That Bends, Twists and Turns", May, '66). A light source

would be placed at one end to throw a cold light of great intensity through the rods into the patient's bladder. A television camera attached to the cystoscope would transmit the picture to television screens in the operating room or in another area where students could follow the surgeon's procedures.

Color photographs and motion pictures using this system have already been made by the Dept. of Urology.

Though not useful in the treatment of patients, said Dr. Lattimer, the device has great potential as a teaching tool.

Irradiated mushrooms

Radiation as a mushroom preservative is the subject of a research program launched by West Foods Mushroom, Inc. Roland E. West, president of the firm, said that a joint study by the U.S. Dep't. of Agriculture and Atomic Energy Commission, "showed that in the case of mushrooms, the radiation passes right through the mushroom, killing decay-producing organisms and breaking down decay enzymes as it travels."

This, in effect, places the mushroom in a state of hibernation and provides a level of preservation, flavor and appearance superior to anything being used now, according to West.

Radio-pasteurization has already been approved by the U.S. Government for use on white potatoes, grains and canned bacon.

Seeing the invisible

Physics and science students are now able to "see" infrared or ultraviolet radiation. The educational spectrometer, which makes it possible to measure those segments of the electromagnetic spectrum not detected by the human eye, was patented recently by Richard W. Hall and Frederik Engel.

A compact teaching aid, the educational spectrometer is designed to demonstrate laws of optics and physics pertaining to infrared, visible and ultraviolet radiation.

The instrument, for example, will help the student understand the laws of light transmission, absorption and reflection; it permits him to test optical components and equipment, and see the aberrations in the images formed by a spherical mirror; it shows how light can be split up into a spectrum by means of a diffraction grating.

The student will be able to ob-

Teacher demonstrates electromagnetic radiation with educational spectrometer.

serve the presence of carbon dioxide in the atmosphere and to learn about a technique which has already led to a novel way of measuring the air temperature in front of fast-flying aircraft.

Air crashes without fires

The Scott Paper Co.'s polyurethane foam promises to play an important new role in airline—as well as auto—safety.

Scott is talking with the FAA about packing airplane fuel tanks solidly with polyurethane foam. The fuel in a foam-filled cell has no opportunity to explode, even under crash conditions. Yet the foam is so porous, its presence would reduce the capacity of the fuel tank by no more than 3 per cent.

Here's why it works: Liquid kerosene doesn't burn. It's only the vapors that are explosive. The foam holds the fuel in a stable state, keeps it from sloshing around in the tank and thus keeps vapors from forming. The mid-air explosion that occurred over Elkhorn, Md., a few years ago resulted from the ignition (probably by lightning) of vapors formed in the fuel lines. The FAA is looking into packing the foam into fuel lines as well as tanks.

Polyurethane foam also prevents fuel from gushing out of a spilt tank—again halting the formation of vapors. Another property of the foam is that an explosion won't pass through it—because its pores aren't large enough to give the explosion room to "breathe." Foam-filled fuel tanks would no doubt drastically cut down the incidence of fire after crash.

For about a year, the Firestone Co. has been making foam cells (under an agreement with Scott) for racing cars. In the Indianapolis 500, all the cars have been so equipped. The racing drivers' association is enthusiastic about them, and recommends them to all drivers. Car safety experts would like to see the foam cells used on cars that have fuel tanks in the front (like VWs and Corvairs), and hence are vulnerable in head-on collisions.

Shellfish farming

Profitable shellfish farming can be a reality within the next five years along the east coast, a professor of oceanography said recently. Dr. Nelson Marshall, chairman of the U. of Rhode Island Marine Resources Program, pointed out that, as with lumber, natural resources of shellfish have been exploited, and "we must learn to 'farm' our shellfish."

The efforts of the dozen or so "exploratory" shellfish farms now in operation in southern New England and New York State should be backed by university researchers, said Dr. Marshall, since land grant agricultural experiment stations and extension services have already successfully demonstrated what could be done for land farmers.

Considerable information has been gathered on the productivity

Above: New landing gear of C-119 "Flying Boxcar" is a vent-pierced rubber tube encircling the fuselage. Air jets out through the holes, forming an air cushion on which plane floats before landing. The tubing retracts smoothly while plane is in flight.

Right: The maiden flight of the Tri-Service X-22A. The vertical/short takeoff and landing airplane has a maximum altitude of 25 feet. Both airplanes were developed by Textron's Bell Aerosystems Company.

of the bottom "soil" of salt ponds and estuaries. Other studies underway are concerned with: 1. the nutritional components of sea water; 2. the use of hot water discharges for warming shellfish larval hatcheries; 3. the use of ordinary garden fertilizers to increase shellfish growth; 4. the management of existing shellfish resources.

Computerized bids

In making bids, a businessman contractor may put his head in a financial noose and have trouble getting it out before he hangs.

Now a computer can modify the lethal risks of business life. L. R. Shaffer, professor of civil engineering at the University of Illinois and P. M. Kramer, have developed COBESTCO, (COmputer Based EStimating Technique for COntractors), a system that brings computer speed and precision to the problems of making bids.

The system forecasts costs as most businesses do, breaking the job into smaller work units and pricing them. Information for pricing comes from three sources: assumptions, plans and specifications and data drawn from a special cost library.

Flexible enough to be used by almost any kind of company, in any kind of project, with almost any kind of programming system, COBESTCO shoulders the burden of detail, which for the contractor lessens the risk of operating on a mistaken premise and allows him to use his judgment where necessary.

INVENTOR OF THE MONTH

Very independent inventor

As modern inventors go, Samuel Ruben (above) is an outstanding independent. He invents for industry, but instead of working in a big corporate laboratory, he runs his own in New Rochelle, N.Y. Rather than assigning his patents to an employer, he grants licenses under them to manufacturers.

The *Science Digest* Inventor of the Month has more than 300 patents, mostly for vital but hidden parts of larger electronic devices. Production of his dry electrolytic condenser, which is found in nearly every radio and TV set and in the starters of most electric motors, has reached 300 million units a year.

A tiny Ruben invention, the mercuric oxide dry cell battery, is a component of hearing aids, electronic watches, earth satellites, heart pacemakers and pilots' distress-signal transmitters.

The latest U.S. patent allowed Samuel Ruben is for a refractory material that conducts electricity and can withstand 1,000°C. He expects it to be useful in infrared baking units, electric heaters and other places where current must pass through great heat. The patent number and issue date have not yet been assigned.

Rods made by compressing powdered molybdenum disilicide, vanadium pentoxide and smaller amounts of aluminum and tin oxide are baked and chemically reacted in a furnace.

Samuel Ruben got his first patent in 1922, when he was 22. For a man with no "earned" college degrees, he carries an unusual load of academic honors. He is an honorary doctor of science (Butler University, 1959) and an honorary doctor of engineering (Brooklyn Polytechnic Institute, 1966). In 1963, his principal's licensee, the P. R. Mallory Company, established the Samuel Ruben fellowship in the department of chemical engineering at Columbia University. And the president of George Washington University recently presented him an award as its inventor of the year for 1965.

—*Stacy V. Jones*

Sex study raises ruckus

by Arthur J. Snider

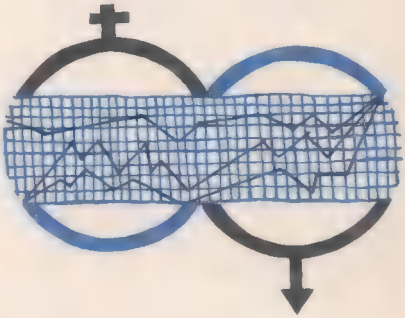
A controversy has developed over the methods used by Dr. William H. Masters, gynecologist and obstetrician on the staff of Washington University, St. Louis, in obtaining data on human sexual anatomy and physiology. Dr. Masters, 50, studied human volunteers in the laboratory for 11 years and published the findings this spring in a book, *Human Sexual Response* (Little, Brown and Co).

Dr. Masters defended the project on the grounds that human sexual maladjustment is the leading cause of marital disharmony and divorce. He said the data obtained will be helpful to professionals who must counsel persons seeking help.

The work was criticized by Dr. Morris Fishbein, editor of *Medical World News*. He said: "The findings obtained are immediately biased by the artificiality of the environment. Sex cannot be properly dealt with except in the totality of human behavior, love, tenderness and concern with feelings."

Dr. George H. Gardner, Northwestern University gynecologist and obstetrician, declared: "I'm embarrassed that a member of my specialty should undertake such a project." Dr. Leslie H. Farber, Washington, D.C. psychoanalyst, criticized the work as "scientizing sex."

Support came from Dr. Lawrence Z. Freedman, University of Chicago psychiatrist: "Masters' contribution lies in going on from the durable information of Kinsey and Freud. The worthwhileness of his work is that it puts knowledge in an area of ignorance. I fail to see that perpetuating ignorance is a virtue."



A University of Chicago anthropologist, Prof. Sol Tax, agreed that the opportunity for obtaining new knowledge is the most significant aspect of Masters' work. "There is nothing sacred about sex as a subject for investigation, any more than studying the stomach and digestion," said Dr. Tax. "The evil is in the minds of those who make it evil. If the work was conducted

properly, if it was done for other than prurient reasons, if there was no nonsense involved, then it was entirely a legitimate study."

The primary volunteer enlistment came from the academic community associated with Washington University's medical school-hospital complex and consisted of medical students, interns, and residents. The lives of many of them were also studied. Others were PhD's, working class people, housewives, stenographers, file clerks, executives, retired people. A sizable group came through referral from clinics and doctors' offices where they had sought help.

Allergic to work

Some people really are allergic to work, and it's not their fault. Industrial employees working with resins, glues, adhesives and foams sometimes develop reactions to these compounds, says a University of Wisconsin medical researcher.

Dr. Louis W. Chosy and his associate, Dr. John Rankin, studied more than 300 persons from various Wisconsin industries who became ill after contact with the new resinous compounds.

Not enough doctors know that these materials can cause respiratory problems, he said. The condition may often be diagnosed as sinus trouble, pneumonia, chronic bronchitis or asthma, all of which are side effects.

Best treatment for these allergic reactions is to stay away from the compounds. If that is not possible, the workman should wear protective clothing, use creams and work in a well-ventilated area.

Industrial workers are not the only ones who develop allergic symptoms to these products. The do-it-yourselfer can be a victim if he doesn't observe the warning that good ventilation is needed.

Sleepless children

Sleep problems in children are common, and the parents are often at fault, says a noted British pediatrician, Dr. R. S. Illingworth. The main difficulties are over-anxiety and over-permissiveness.

"I believe we have gone too far in meeting the basic needs of children for love and security," Dr. Illingworth points out in the journal *Clinical Pediatrics*. "Some mothers react too strongly to the slightest whimper in the baby. They pick him up at the first sound and rock him back to sleep. Whenever the child cries at night, his mother picks him up and frequently takes him into her own bed. Mothers seem compelled to visit the child in the evening 'to see if he is still breathing'. The older child, accustomed to expect these visits, deliberately stays awake until mother has been in to see him."

Dr. Illingworth said some mothers have told them they have to get up 12 to 15 times each night to see the child because he calls out.

Overanxiety in parents comes from a wide variety of factors usually present even before the child's birth. These include advancing maternal age, difficult pregnancy, an only child, worries about the child's "delicacy" and rejection—the result of the mother's own unhappy childhood or her unhappiness in her marital relationship.

"Sleep problems are less common in second and subsequent children," Dr. Illingworth continues, "and this may well be due in some measure to the fact that mothers feel less anxiety about these than about their first children, and also because they now have less time to give to them. Mothers seem to profit from their experience with the first child."

Other causes of sleep problems are:

- Habit formation. When the baby discovers that each time he howls when put to bed he will be taken downstairs again or put into mother's bed, he will howl every night.
- Child's ego and negativism. A child loves to get the whole house revolving around him and his appetite or his sleep. He loves the fuss that is made. Determined parental effects to make him eat or go to sleep seem to have the opposite results.
- Sleep needs. All children are different and so are their sleep needs. Fat, placid babies sleep a great deal more than thin, active ones who are on the go all day. A child at 7 is deemed to need not less than 9 hours, 44 minutes of sleep and at 11, eight hours and 42 minutes, according to one study.
- Child's love for his parents. The child who howls when put to bed is not always naughty. He loves his mother and does not want to be separated from her.
- Errors concerning bedtime. If a child naps too long in the afternoon, he may not be ready for bed at the usual time in the evening.

More snakebites

A questionnaire sent to 5,535 hospitals by Dr. Henry M. Parrish of the University of Missouri School of Medicine shows that there are close to 7,000 snakebites a year occurring in the United States. The previous snakebite estimate had been 1,000 or 2,000 a year.

About 58 percent of the bites occurred in the legs. Only four percent were on the body. The arms accounted for the rest.

North Carolina has the highest incidence of snakebites, followed by Maine, the findings in "Public Health Reports" show. Rattle-

snakes were the worst offenders followed by copperheads and cottonmouth moccasins.

Up came the pin

The little girl, two years old, swallowed a bobby pin. About 90 percent of swallowed foreign bodies entering the stomach pass through the remainder of the gastrointestinal tract. But long objects, such as bobby pins, often fail to pass. Surgery is usually required. However, Dr. Anthony Shaw of New York decided to attempt magnetic retrieval of the pin.

A small, cylindrical magnet was removed from a household pot holder and its sharp edges were filed down. It was then squeezed into the end of a nasograstic tube which was passed through the child's mouth. The magnet made contact with the bobby pin immediately.

In the first two attempts to draw the bobby pin from the stomach into the esophagus, the pin pulled off. But on the next try, the tube was withdrawn with the pin firmly attached. The child was observed for several hours and then sent home.

37 kinds of cold

A study of viruses responsible for the common cold and other acute respiratory diseases in the student population at the University of Virginia has pointed up the complexity of developing a vaccine against these infections. Among 286 students, 37 strains of viruses were isolated. To put all of these in a single vaccine presents obstacles, Dr. Jack M. Gwaltney, Jr., reported in *The American Review of Respiratory Diseases.*

"Certain populations, such as young children and military recruits, may be benefitted by immunization because they experience unusually high rates of infection with relatively few antigenically distinct viruses," said Dr. Gwaltney. "Populations such as the one we have studied obviously would be difficult to protect by immunization. These problems are leading to an intensified search for antiviral drugs, as well as for better means of biologic control."

Teenage parents

Out-of-wedlock pregnancy in teenagers is a serious problem, a study in New York City shows. Children of such teenage parents receive prenatal care late or not at all and the mothers have frequent complications of pregnancy. The future of the child is in danger because it may be adopted without the guidance of qualified agencies.

Dr. Helen M. Wallace, University of California, says in the *American Journal of Obstetrics and Gynecology* that since teenage pregnancy is a cause of school dropouts, the community should organize education and training and find employment for the girls.

Teenage marriages are the most fertile. In 1960, some 600,000 children were born to mothers 15 to 19 years old. A first pregnancy at 14 or 15 is often followed almost immediately by a second, said Dr. Wallace. The infants are often of low birth weight and are subject to brain injury.

Say it's cancer

Patients should be confronted directly with the word "cancer" when the diagnosis is made rather than have the physician regard the term as a "dirty six-letter word," says Dr. Bertram B. Moss of Chicago.

He contends a patient's fears are "only compounded when we announce the diagnosis in cathedral tones, describing it as a malignant tumor or using any other euphemisms that will enable us to avoid the word "cancer."

The shock of receiving the diagnosis can be tempered by reassurance and hope. "If you are as confident as I am that most cancers will be conquered in the near future," Dr. Moss told the Illinois Academy of General Practice, "then you should share that confidence with your elderly patients and their relatives instead of avoiding all discussion—an easy way out for all concerned except the patient who then is not encouraged to seek relief."

Total despair should never be voiced in front of patients, even if the cancer is considered "incurable."

Cars that kill

States that inspect automobiles for mechanical defects had a lower death rate for the male population between the ages of 45 and 54 when compared with non-inspected states.

Dr. Robert C. Buxbaum of Harvard Medical School based the conclusion on an analysis of U.S. motor vehicle inspection data for the year 1960.

Nine of the 50 states conducted two automobile inspections a year, eight others required one inspection.

In other data gathered, Dr. Buxbaum noted that (1) death rates tended to be higher in the western United States; (2) lower death rates are associated with persons of higher income, especially in those states requiring inspections; (3) the more urban a state, the lower its death rate; (4) the higher the population density of states, the lower the death rate; (5) the greater the automobile density, the higher the death rate.

I see where they...

From the Editor's desk

. . . say we have a new set of repressed feelings to replace the ones we had in Freud's day. At least, that's the opinion of Dr. Erich Fromm. Sexual desires and fantasies, Sigmund Freud said 50 years ago, made up much of our unconscious. Since then, psychoanalyst Fromm now says, they have become less and less repressed, so that they don't govern our psychodynamics so much. What we repress today, according to Dr. Fromm, is our "underlying anxiety, depression, loneliness, boredom and pain about the meaninglessness of life." For example, as he puts it:

"A man sits in front of a bad television program and does not know he is bored; he reads of Vietcong casualties in the newspaper and does not recall the teachings of religion; he learns of the dangers of nuclear holocaust and does not feel fear; he joins the rat race of commerce, where personal worth is measured in terms of market values, and is not aware of his anxiety. Ulcers speak louder than the mind."

. . . think it's possible spacemen may already have visited Earth. Dr. Carl Sagan, Harvard's noted astronomer, has expressed the possibility that they may have come here thousands of times during the history of our planet, including even man's span on Earth. There's no evidence that has been discovered, perhaps because the weather washed or blew it away. But the odds are that we have indeed had visitors because it now appears that billions of planets can sustain life as Earth does.

. . . have found that dreams may serve a useful mental purpose. Dr. Arthur Shapiro, a University of New York psychiatry

professor, says, "It is quite possible that during sleep we select and process life's experiences in terms of their significance to us." The mechanism could determine the way our personalities develop.

A fellow psychiatry instructor, Dr. Frederick Baekeland, reports that we may soon be able to predict what we dream. He asked volunteers to talk about anything that occurred to them (to "free associate") for half an hour before they went to sleep. Then he woke them periodically to ask what they were dreaming about. He found a surprising correlation between their dreams and their pre-sleep thoughts.

Footnote: Studies at the School of Medicine at the University of Cincinnati indicate that hallucinations known as delirium tremens (DT's) in alcoholics stem from the fact that the heavy intake of alcohol suppresses dreaming in sleep.

. . . say Saturday is the most dangerous day of the week on the highways. Statisticians of the Travelers insurance companies report that 21.9 percent of all fatal highway accidents occur on Saturday. The most dangerous hours, any day of the week, are between 5 and 8 p.m., when nearly 20 percent of all fatal accidents occur.

. . . are wiring drinks to train alcoholics to cut it out. Patients at St. Vincent's Hospital in New York City are given trays with glasses containing fruit juices, soft drinks and highballs. Every time they touch a highball, they get a shock equal to about half the jolt you get when you accidentally make contact with an electric socket. The shock comes from an electrode attached to the patients' arms. Doctors say the system is supposed, as they put it, to "reinforce will power."

. . . discovered that termites have their own air-conditioning systems. Harvard's Dr. Edward O. Wilson says 10 million termites sometimes live in one nest 10 to 15 feet high. For survival, air-conditioning is essential. They achieve that by building ducts. A central one carries hot air up it; the hot air then moves down through ducts in the outer chambers of the nest. The outer walls conduct the hot air to the exterior, and the cooled air moves to the lower levels of the nest, to be recirculated. Dr. Wilson says the termites apparently are born with the knowledge of how to build their air-conditioning system. All termites in a nest are the offspring of one king-queen couple. But nothing is known about the machinery that decides who gets what work assignment.

. . . predict 30-hour days. Two UCLA assistant professors of astronomy and geophysics, S. J. Peale and Peter Goldreich, say the earth is turning more and more slowly all the time. If you can't get everything done in a 24-hour day, you can look forward to a 30-hour day about half a billion years from now.

The natural camouflage of the stick insect makes it indistinguishable from a twig, a protection that allows the insect almost complete freedom from predators. Some species also have spines along the outer edge of the legs and in parts of the thorax.

The insect you can't see . . .

AUSTRALIAN farmers will remember 1965-66 as the summer of the stick insect, when their eucalyptus forests were defoliated by swarms of the leaf-eating creatures.

Because the insect's protective shape renders it virtually invisible to the observer, farmers were at first unable to detect the cause of the damage to the eucalyptus trees, the chief staple of the insect's diet.

Species range from two to 10 inches in length and vary in color from brown to a green, pink and silver combination.

Most insects undergo metamorphosis to achieve adulthood; stick insects do not.

. . . now you can

The stick insect has the external skeleton, six legs and segmented body and legs of all insects. There are both winged and wingless varieties; most move by crawling slowly up and down the vegetation, halting repeatedly to assume their camouflage postures.

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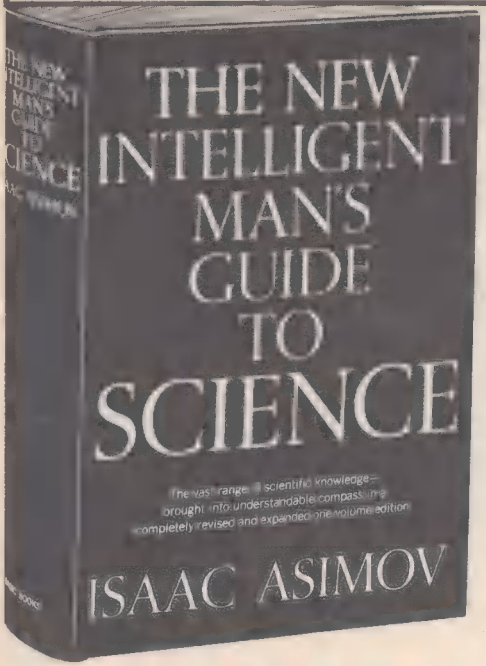

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PERSONALITY OF THE MONTH

The man who looks for trouble

Mason Comer looks meticulously for small but costly flaws in rockets.

by L. B. Taylor

WHEN the Gemini 6 rendezvous flight of astronauts Wally Schirra and Tom Stafford was temporarily grounded last winter, and a tiny plastic dust cover was found in one of the engines, the American public was appalled.

How, people wanted to know, could such carelessness happen, particularly when the two-cent item came perilously close to destroying a multi-million dollar rocket and endangered the lives of the two astronauts?

But to one man at the launch site such a human error was not only understandable, but, sooner or later, expected. The man was Mason R. Comer, Jr., a barrel-chested mechanical wizard from the hills of West Virginia. He has the most unusual job at Cape Kennedy.

As a trouble-shooting staff engineer for the National Aeronautics and Space Administration, the 45-year-old Comer has free rein to examine America's unmanned, flight-ready rockets.

If, during his informal but thorough inspections, be they on the ground-floor missile engines, or 100 feet high in the spacecraft's complicated innards, Comer finds anything out of place—down to a single stray brush bristle—he can call an instant halt to the countdown. Only when he is personally satisfied that everything is all right can the launch proceed.

That he is not an easy man to please has undoubtedly saved the U.S. taxpayers millions of dollars. In his nine years at the Cape, Comer has uncovered more than 150 major items on launch-ready rockets, many of which, if left unchecked, would have resulted in a scrubbed or postponed flight at best; a destroyed missile at worst.

One of Comer's first jobs bears this out. On March 16, 1958, at launch complex 18, a pencil-thin Vanguard space rocket stood ready for flight, with a grapefruit-sized satellite perched atop its third stage. This mission was doubly important to America, for an earlier Vanguard had unceremoniously blown to pieces three feet over its launch pad only a few months before, and U.S. rocketry prestige was on the line.

Toting an odd assortment of apparatus, Comer flashed his badge to the security guards and calmly sauntered through the gates that morning unnoticed by the dozens of aerospace mechanics frantically making last-minute checks on the rocket.

Methodical inspection

At each level in the gantry he stopped and carefully, methodically inspected the Vanguard's stages; probing here, testing there. Time on the countdown was growing short when he noticed something on the second stage. He bent down and found a tiny screw that had somehow chewed its way into the underside of a fuel tube.

His discovery in the 11th hour halted the launch for a day until repairs could be made. Had the screw, which cost a few cents, gone unnoticed, it could have caused another failure for the multi-million dollar space vehicle.

Instead, the Vanguard was rescheduled for the next morning—St. Patrick's Day—and was launched into a near-perfect earth orbit, where the diminutive satellite is still circling today.

Comer's list of such "saves" is lengthy and impressive:

—On a Tiros weather satellite he found a wire that had been brushed loose in last-minute cleaning.

—On a Relay communications spacecraft he pointed out possible problem areas down to tiny inner cablings.

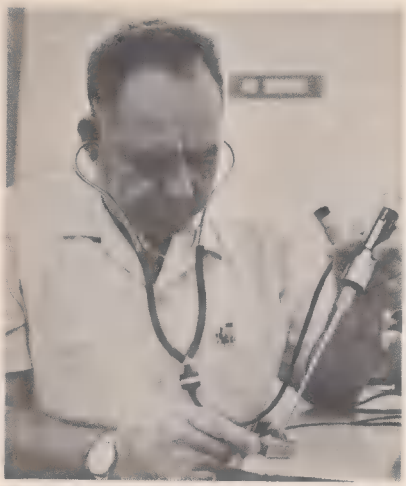
—On an Atlas-Centaur he found a minute deposit of carbon precipitation in the rocket's stainless steel tubing.

—On a Syncom stationary satellite he correctly predicted a certain type of plastic would fail under stress, causing the manufacturer to redesign his product for subsequent flights.

Without even the benefit of a bachelor's degree in engineering—at a place where PhDs are commonplace—Comer relies on two decades of hard-knock experience in the aerospace business to help him ferret out elusive flaws.

Space-age apprentice

A native of Lowell ("a little one-horse town"), West Virginia, he enlisted in the Army in 1939 after graduating from high school. Following his discharge at the end of the war, Comer attended the Capital Radio Engineering Institute in Washington and received a diploma. He entered the missilery field soon after by landing a job with the Naval Research Laboratory in D.C.,



Comer, a seat-of-the-pants mechanic, uses an assortment of instruments on the job.

where he worked on Aerobee research rocket experiments.

But it was at White Sands, New Mexico, that he served his real space age apprenticeship. There, he learned the guts of American missile systems by helping hand-build from scratch Viking high-altitude research rockets. When he wasn't personally tinkering with the machinery, he was asking such questions as "what does this gizmo do," or "how does that thing work?"

He never mastered the tongue-twisting engineering vernacular, but, over the course of years, he gained a first-hand practical knowledge of every component in a complex rocket system.

He transferred to Cape Canaveral in 1956, and after the first Vanguard blew up on its launch pad a year later, he was given his shot as a roving trouble shooter and he made the most of his opportunity.

He lives in the appropriately-named community of Satellite Beach, about 25 miles south of the Cape, with his wife, Edith, and their four children.

Working primarily on Delta, Atlas and Centaur rockets and various unmanned spacecraft today, Comer has earned such a widespread reputation for diagnosing potential trouble areas that his bosses, who direct launch activity, won't give the go-ahead on a flight without his word.

In a governmental world of confusing specifications sheets, lengthy, red-tape inspection reports and strict adherence to "the book," he is a complete oddity. He follows no set rules, but uses, instead, an uncanny perceptive knack for spotting stray solder flakes, miniscule metal chips, broken wires, brush britles or a hundred other defects that would escape less trained eyes.

Because so many transistors and diodes and various other items among each rocket's hundreds of thousands of parts are too small even for Comer's sharp eyes to perceive any faults, he works a great deal with microscopes. One unitron metallurgical scope, for instance, can magnify objects 2,200 times in photographs. Other paraphenalia include an electronic stethoscope, a flexiscope for "seeing around corners," leakage detectors and an X-ray machine. This equipment and dozens of missile components under study are scattered through two labs at the Cape.

Although he is busy from the time a "bird" arrives at the Space Center until it is launched, pressure spots invariably develop during the final hours of a countdown.

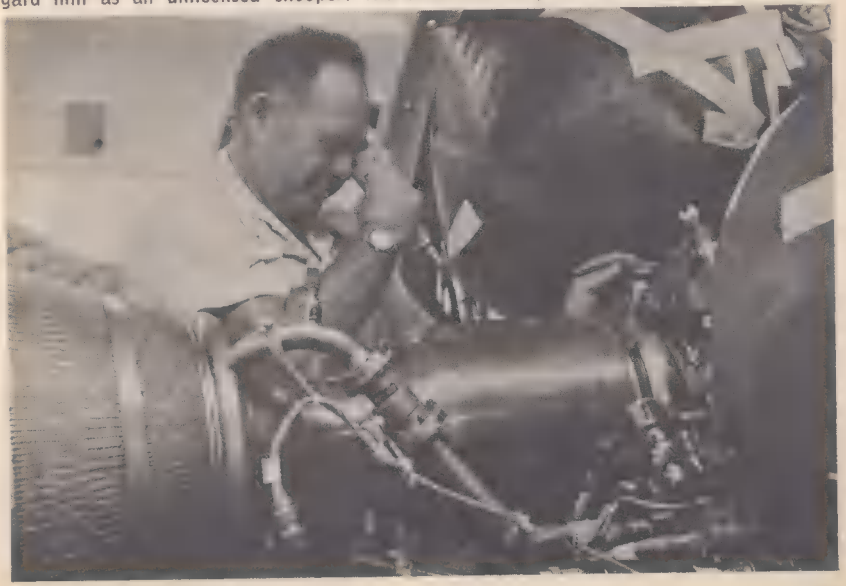
Comer is a tireless, dedicated government employee, and often when a count is in its final hours or days, he catnaps in a sleeping bag at the Cape so he can get to the launching pad within minutes if trouble develops unexpectedly.

He works by a simple rule of thumb: if, during his inspections, he sees something he doesn't understand, he never hesitates to call someone over to explain it to him.

This has sometimes led to embarrassing situations. One new contractor balked when Comer first asked them to "open up" their rocket. They considered him an unlicensed snooper. He insisted, however, and the inspection resulted in an inch-thick book full of discrepancies. The company has since revamped its quality control program. Other agencies at Cape Kennedy have also come to respect his skillful work, and he is frequently called in as a consultant to help solve problems on contractors' rockets.

Mason Comer is the first one to admit that his method of operation is unorthodox, but a quick glance at the launch records of missiles he's worked on reveals how successful his uncoverings have been. The Delta's, for example, with 31 successes out of 33 flight attempts, is one of the best ever accomplished at America's Spaceport.

Comer's unorthodox technique and inability to speak engineering jargon led some to regard him as an unlicensed snooper. His successful inspections changed their minds.



TIPS AND TRENDS

"C.I.A. SPIES FROM 100 MILES UP." That New York Times headline in a recent edition heralds the new trend in spying: Send up a satellite to do it. With computers, cameras, radars and other gadgets in vehicles circling the globe, says the Times, "C.I.A. agents are able to relax in their carpeted offices and count the intercontinental missiles poised in Soviet Kazakhstan, monitor the conversations between Moscow and a Soviet submarine near Tahiti, follow the countdown of a sputnik launching, track the electronic imprint of an adversary's bombers, watch for heat traces of his missiles." Other reports indicate the U.S.S.R. is doing the same thing with Cosmos satellites. For down-to-earth snooping, says the Times, the C.I.A. is developing a new addition to its gadgetry. It's a device to pick up indoor conversations from afar by recording the window vibrations caused by voices.

CAN THE PILL CUT DOWN LIBIDO? Medical World News reports that some physicians believe it can. It quotes Dr. William Masters of the Reproductive Biology Research Foundation in St. Louis: "When referring physicians or marriage counselors ask us to see a woman for secondary frigidity, our first question is, 'Has she been taking the pill?' If the patient has been taking tablets for more than 18 months, we insist that she discontinue medication for six months before we see her. In most instances, further steps have proved unnecessary."

MEASLES--WARNING AND PROMISE. The "German" variety, or rubella, when contracted by pregnant women, is leading to an increase in deafness among babies. The first three months of pregnancy are the danger period. Meanwhile, two scientists of the National Institutes of Health say they have developed what appears to be the first effective vaccine against rubella. It is an attenuated virus vaccine that protects for long periods without being strong enough to allow the virus to be transmitted to others by the vaccinated person. The vaccine, developed by Drs. Harry M. Meyer and Paul D. Parkman, is still being studied.

CHEAP NEW FUEL CELL. It's being developed by Australian scientists to power microwave relay stations and replace diesel generators developing 100 watts of power. About two cubic feet in size, it will have a battery voltage of 24. It's said to be inexpensive and require little maintenance.

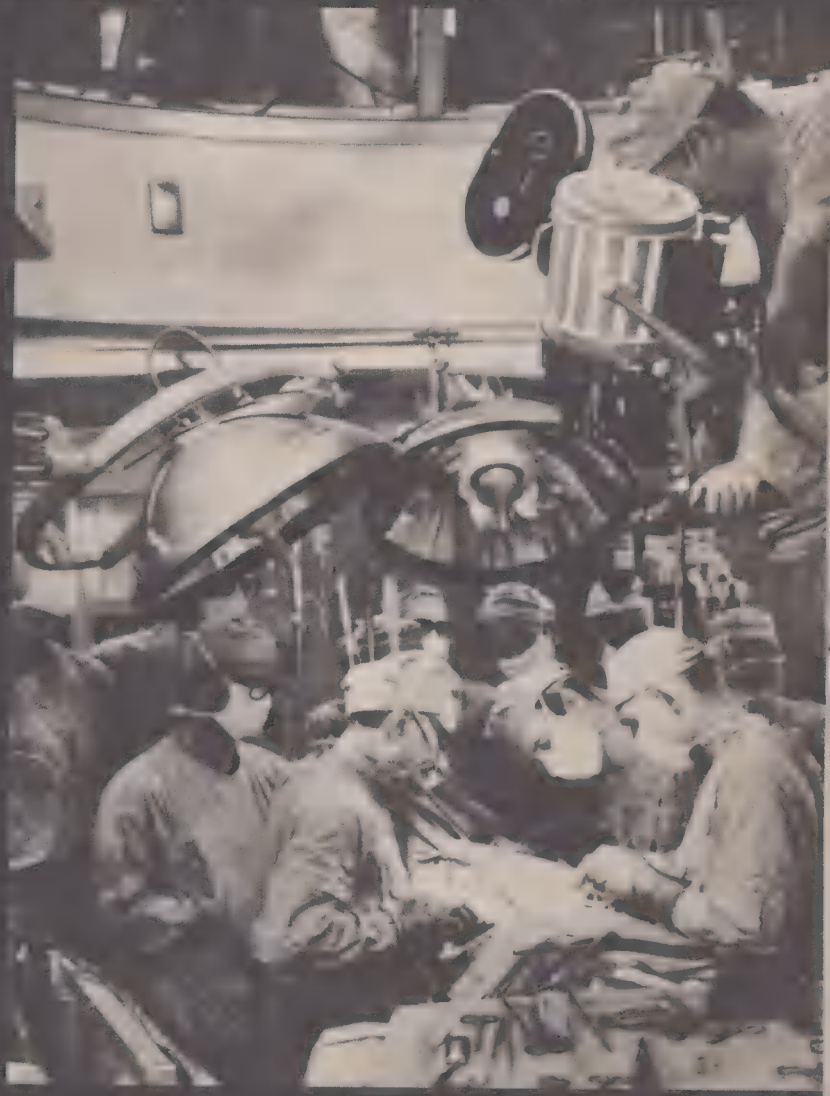
NEW HOPE FOR GOUT SUFFERERS. Duke University Medical Center researchers are testing a new drug that could help half of America's 400,000 gout victims. It's called allopurinol, which reduces the uric acid excess in gout sufferers.

WANTED: AIR POLLUTION RESEARCHERS. There's a new career opportunity in the growing need to find ways to control air pollutants. About $20 million will be spent in that area this year. A New York Herald Tribune report indicates greatly increased expenditures in the future. Research today is done by government, colleges and industry.

THE MEDICAL PICTURE

The most important

Tense surgical team implants first successful "artificial heart" at Houston's Methodist Hospital. Cameraman records technique that may save thousands



operation in history

Dr. Michael DeBakey inserts "heart," actually a bypass pump. It was only hope for patient, who died 41/2 days later of unrelated causes.

Bypass pump is sutured to arteries so blood flows through pump instead of left ventricle. Pump is designed to take over 80 p.c. of heart's job.

A pause in the five-hour operation allows Dr. William Akers to wipe DeBakey's brow. Akers heads the Rice engineering design team, finding ways to reduce blood injury. The pump is the 66th model designed in a joint program of Baylor U. College of Medicine and Rice U. Ultimate aim is a complete artificial heart.

Above: After implant, the blood can be seen as it circulates through the bypass booster, pumped by spurts of gas blown in through top tube. Wires lead to monitoring equipment that keeps tabs on conditions.

Right: Medical attention continues around the clock as patient, Marcel DeRudder, lies in intensive-care room after surgery. Though his condition improved, he never regained consciousness post-operatively.

Left: Hardy Bourland, supervisor of Rice's bio-medical engineering lab, checks mechanism closely. Heart disease causes 30 p.c. of U.S. deaths.

Dr. DeBakey's surgical team congratulates him after the operation. An exacting taskmaster, DeBakey took team of 20-plus through a complete dry run the day before

Drs. DeBakey and Akers explain the potential of pump for saving the lives of 400,000 heart attack victims a year. Once perfected, the pump could be mass-produced

The Houston team now has a pump that can assume the bulk of the heart's job without injuring the blood. This design breakthrough will begin an era of replacement parts for defective, ailing hearts. The bypass pump offers hope to the 500,000 annual victims of heart disease. For outlook of design progress, turn the page.

Dr. William Akers holds model of successful pump design. He heads the Rice engineering research team.

Outlook for the artificial heart

by Jeanne Reinert

ONE day soon—perhaps by the time this article is in print—the first successful prototype of an artificial heart, of the kind pictured on the preceding pages, may be helping a patient back to health. His natural heart, temporarily relieved of most of the workload, will have a chance to heal.

That was the lesson learned in the 100 hours following the Houston implant. Shortly after the death of the history-making first patient, Marcel DeRudder, Dr. Michael DeBakey observed, "His life could not have been prolonged with a better heart pump."

The first effective use of an experimental pump wasn't likely to help the 65-year-old former coalminer. Childhood rheumatic fever had weakened his heart: Several heart attacks in the hospital during the days preceding the operation left him all too aware of how ill he was. "He recognized himself the seriousness of his condition and knew that he had been deteriorating very rapidly," explained the surgeon, Dr. DeBakey, to NBC's "Meet the Press." The slim hope that the bypass booster pump might restore his health was eagerly grasped, as it will be by others of the half million Americans who will die of heart disease this year.

The bypass booster pump could help as many as 400,000 heart attack victims a year, estimates Dr. C. William Hall, a surgeon and associate in the DeBakey program.

The dream of an artificial heart has engaged researchers since 1950. Dr. DeBakey, a surgeon with 10,-

000 cardiovascular operations to his credit, and his team at Baylor University College of Medicine, began work on the bypass about 10 years ago. In late 1963, he invited engineers at Rice to join in a multidisciplinary joint effort. The ultimate goal of their research, underwritten by a $4.5 million federal grant, is a design for a total replacement of the heart within five years. Bit by bit, problems were overcome by researchers across the country (see "Spare Hearts Are Already Here," Feb., 1966). The hurdles are formidable and many still are uncrossed.

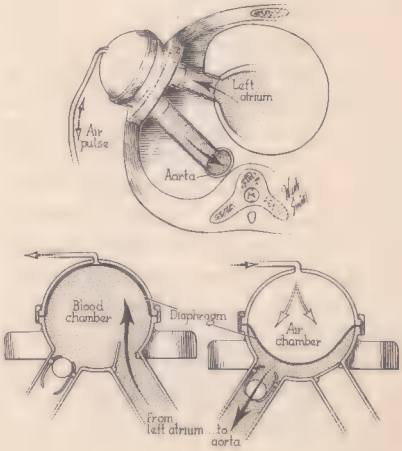
With the DeRudder implant, another question was answered. "The pump will take over as much as 80 percent of the function of the left ventricle, and at the same time, do it without any destruction or damage to the blood, which of course is absolutely essential to any pump. Up to this point, we had no evidence that this could be done in a human being," Dr. DeBakey explained.

Two other patients had earlier implants of artificial hearts. Dr. DeBakey put one in a patient in 1963. Four days later, the pump was still working, but the patient died of a breakdown of the liver, kidneys, brain and lungs. In February, Dr. Adrian Kantrowitz and colleagues of Maimonides Hospital, Brooklyn, attached one, but the patient died of liver disease 24 hours later.

How does it work? The DeBakey pump sits on the chest, a clear lucite plastic hemisphere protrudes, looking like half a grapefruit. Inside, a flexible Silastic diaphragm is rhythmically pumped in time to the heart's natural pacing. As the diaphragm pushes and pulls the blood through the protruding globe, about 75 percent of the normal blood flow is diverted to the new chamber. Thus the left lower chamber, the ventricle, has to handle only the remainder.

Power is furnished by a 25-pound compressor which is attached by hoses to the top of the transparent globe on the chest. Puffs of carbon dioxide power the pump rather than air which would be immediately fatal if a leak into the bloodstream occurred. Wires also are connected to the pump so its performance can be monitored.

As the pressure rises and falls in the artificial chamber, a ball-bear-



Top diagram shows where pump is tied to heart. Bottom shows alternate suction and pressure rerouting blood through pump.

ing device acts as a valve to send the blood pulsing through a Dacron artery sewn into a hole made in the aorta, a giant artery which then distributes the blood to the body.

Many designs of pump have been tried in Houston, site of the DeBakey research effort, and in centers in Cleveland and New York.

A key problem with all designs is to pump the extremely fragile blood 77 times a minute without damaging it. As blood is pounded against nonliving surfaces, delicate blood cells are bruised and ruptured. On some fibers such as plastic and metal, blood will lay down a protein fraction. This coating is of the blood itself. However, this frequently is a touch-and-go business as any jarring may tear this coating into shreds. Loose lumps of blood—clots—may then flow through the circulatory system, perhaps causing strokes or death.

This blood damage occurs in the well-known heart-lung machine. These machines can oxygenate and pump blood during "open heart" surgery, but they still batter the blood. Constant transfusions, averaging 20 pints of blood per operation, must be given to compensate. It also explains why heart-lung machines are not adaptable to the "artificial heart" concept.

The Baylor-Rice team found a nylon velour capable of holding the protein fraction. In seconds, blood will lay down a protein coat and travel through a velour-lined pump as undisturbed as in a natural artery or vein. The dependable lining is a king-sized step for the DeBakey bypass booster pump.

For four days, model No. 66 took over most of the work of DeRudder's heart.

"There was no evidence of blood trauma," rejoiced the team of experts who had spent years designing, trying and improving pumps. Even the blood clot that kept DeRudder from regaining consciousness after the operation was a product of his own system, a breakaway piece of clot that the surgeons found in his left auricle during the replacement of a heart valve.

Advantages of booster pumps are numerous. Since the heart's own pacer can time the pump, it's easier to imitate the balance of blood pressure found under normal conditions. The left lower chamber can heal while carrying only a partial load. As the heart begins to heal, the booster pump's load can be gradually lessened so the patient is weaned from the machine. Then the bypass pump can be removed and a skin flap sewn over the connector.

Dr. William Akers, a Rice chemical engineer in charge of bioengineering aspects, says, "Once the technological problems of replacing one ventricle have been solved, there should be no great engineering problems in the way of replacing two." A combination of right and left ventricles would provide a complete bypass of the heart.

Eventual goal is an instrument completely contained within the body, powered by nuclear energy or skeletal muscle.

"Once available, the artificial heart will entail considerations which will impinge upon the minds and consciences of not only physicians but also philosophers, theologians, sociologists, jurists and many others," wrote Dr. DeBakey in the *Journal of Rehabilitation* recently. "On the one hand we have the tool and on the other, the candidate. Should this life-saving device be made available to every patient, even the hopeless victim of stroke, cancer or senility?

"Or, should an unbending and restrictive criterion for use be outlined? When and how does one determine death due to other causes? And who decides when to terminate the power flow in such cases?" Although these questions are hypothetical today, they pose problems that are the logical outcome of the hoped-for success by heart researchers.

In the meantime, researchers around the country study blood flow, power sources, material fatigue. In Dr. DeBakey's words, "When it does become a reality, the artificial heart will emerge not as a dramatic breakthrough, but as the accumulative precipitate of many a small breakthrough."

Peach-fuzz velour replaces blood vessel

WHAT would you use to replace a blood vessel? Teflon? Dacron?

Medical researchers who helped pave the way for April's crucial heart operation in Houston had to find the answer because the heart pump is one thing; another is the series of connections that join it to the human circulatory system.

Dr. C. William Hall, in charge of the animal research portion of the Baylor-Rice heart program, jotted down characteristics as each material was tested—for days and weeks—as a potential replacement for blood vessels.

Finally, nylon velour, a soft fabric like peach fuzz, was inspected.

"The surface was very smooth and shiny. It looked like the inside of a blood vessel. None of the whiskers could be seen, though you could see through the shiny surface," reported Dr. Hall, after the autopsy of the animal with the velour implant. "And you couldn't tear the surface off."

An assistant was dispatched to the fabric department of Foley's, a Houston department store. Only the end of a bolt was left. It took weeks to trace the fabric to its manufacturer. Foley's had bought it from a dealer who bought it from someone else who bought it from the manufacturer.

When the material's manufacturer was located, the heart researchers found he made a similar but even more suitable nylon velour. Tests followed tests until the team found the best combination of warp and weft—a soft, fuzzy material, just right for the lining of an artificial heart pump.

Threat of punishment will keep a child from doing what he should not. But will he continue to obey even when you turn your back?

How to get obedience

by Elliot Aronson

Most psychologists, parents and employers have learned that if one wants a rat, a pigeon, a four-year-old child, a college sophomore or a factory worker to do something, good results can usually be attained by rewarding "good" behavior or by threatening to punish "bad" behavior. Ice cream cones, spankings, food pellets, electric shocks, ridicule, flunking grades, high salaries—these have all been used successfully to control the behavior of children, laboratory animals or adult humans. Generally, the larger the reward or the more severe the threat of punishment, the greater the likelihood of compliance.

But to induce compliance by rewards and punishments is terribly inefficient, because in order to ensure continued compliance, rewards or punishment must also be continued indefinitely—and often in increasing doses. The indulgent mother must keep doling out candy, the tough foreman can never relax. It would be much more efficient and desirable if society could somehow induce people to enjoy doing things that must be done, and refrain from doing those things that society considers undesirable. For example, few people would run a stop sign if a policeman always stood alongside, pencil conspicuously poised, ready to issue a costly ticket. But it would be more efficient if all drivers could be persuaded to quit running through stop signs, policeman or no.

Such a technique of persuasion—

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or self-persuasion—is quite possible. It can be derived from Leon Festinger's theory of "cognitive dissonance" which states, briefly, that when a person simultaneously holds two incompatible ideas (cognitions), dissonance occurs. This creates internal tension. Such tension is unpleasant, and the individual tries to diminish it by reducing the dissonance. This can be done by changing one idea (cognition) or the other to bring them closer together and make them more compatible.

For example, suppose one man lies to another. He knows there is a great disparity between what he believes true and what he has said. If he considers himself to be a basically truthful person, dissonance is set up. One way for him to reduce it is to rationalize—to convince himself that it wasn't such a big lie after all, and therefore closer to the truth than it seemed. This involves changing prior attitudes and beliefs. An even better technique to diminish dissonance is to justify the lie, since the amount of dissonance depends on the strength of his motives (what caused him to lie in the first place?). The greater the pressure and need to lie, the less the dissonance. For example, if he told a small lie to save a life, or to become very wealthy, he will experience little dissonance—the consequences help justify the act. "All right," he can say in effect, "so I told a lie—but it was worth it." His basic attitudes have not changed; he still sees himself as the same truthful person, adapting to exceptional circumstances.

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But if he receives little or no reward for lying, he will have a great deal of dissonance, and will much more likely change his prior attitudes ("It wasn't such a big lie") to cut down the tension.

Several experiments in the last few years support this idea: people who tell a lie—say things they do not think right—and get only *small* rewards for them, undergo *greater* changes in attitude than those who tell the *same* lies for *large* rewards.

Punishment, attitude

A few years ago, Merrill Carlsmith and I applied dissonance theory to the problem of punishment, in an attempt to understand the relationship between degree of punishment and extent of attitude change. We reasoned that if you threaten to punish a person for a particular action, the more severe the threat, the greater the likelihood that he will refrain from the activity—while you are there watching him. But if you reduced the threat, you might succeed in producing a more permanent change in behavior through inducing a dislike of that activity.

For example, suppose you have a young child who likes to beat up his little brother and you want him to stop. Probably the best way to get him to stop is to threaten to hit him and hit him hard. The more severe the threat, the greater likelihood that he will stop, at that moment, while you're watching him. However, he may very well hit his brother again as soon as you turn your back.

But suppose instead that you threaten him with a very mild punishment—a punishment which is just barely severe enough to get him to stop aggressing at that time. In either case—under threat of severe punishment or of mild—the child is experiencing dissonance—he is aware that he is not beating up his little brother while also aware that he wants to. When the little brother is present, the child has the urge to beat him up, and when he refrains, he asks himself in effect, "How come I'm not beating up my little brother?" Under severe threat he has a ready answer: "I know damn well why I'm not beating up my little brother. I'm not beating him up because if I do, that giant standing over there (my father) is going to knock the hell out of me." In effect, the severe threat of punishment has provided the child with justifications for not beating up his brother, at that moment, while he's being watched.

No good reason

But consider the child in the mild threat situation; he experiences dissonance too. He asks himself, in effect, "How come I'm not beating up my little brother?" But the difference is that he doesn't have a good answer—because the threat (loss of candy, for example) was so mild that it does not provide complete justification for staying stopped. In this situation he con-

Severe threats made the forbidden object more attractive to children.

tinues to experience dissonance. There is no simple way for him to reduce it by blaming his inaction on a severe threat. He must, therefore, find reasons consonant with not hitting his little brother. He can, for instance, try to convince himself that he really doesn't like to beat his brother up, that he didn't want to do it in the first place.

Mild threat test

In sum, Carlsmith and I suggested that one way to get a person to inhibit an activity is to get him to devalue it—and one way to get him to devalue it is to stop him in the first place with a mild threat rather than a severe one.

In our experiment, for ethical reasons, we did not try to manipulate basic values like aggression (beating up brothers). Instead, we chose a much more mundane value —toy preference. We first asked children to rate the attractiveness of several toys; then we chose one that a child considered to be quite attractive, and we told him he couldn't play with it. With one experimental group we threatened mild punishment for transgression —"I would be a little annoyed"; with the other, we threatened severe punishment—"I would be very angry. I would have to take all of my toys and go home and never come back again. I would think you were just a baby." After that, we left the room and allowed the children to play with the other toys—and perhaps to resist the temptation to play with the forbidden one. On returning to the room, we remeasured the attractiveness of all of the toys. We found that those children who were forbidden to play with a toy under a threat of mild punishment now derogated the toy. Those children under a severe threat did not derogate it.

Subsequent experiments have confirmed and extended our conclusion. In one recent experiment, Elizabeth Ann Turner and John C. Wright have confirmed our finding. In addition, they have shown clearly that derogation of the crucial toy occurs in the mild threat (high dissonance) situation in spite of a strong general tendency for children to overemphasize the attractiveness of a toy with which they have had little experience. That is, while they refrained from playing with the crucial toy, they *were* playing with other toys. The crucial toy was rated as less attractive (relative to the others) in spite of the fact that they tended to become satiated with the others. In a control situation where no threats were used, but the crucial toy was simply concealed from the children, they rated it *more* attractive than the others. Thus, not only did Turner and Wright show that a mild threat

induces children to derogate the toy, they also showed that this dissonance effect is a very powerful one—powerful enough to overcome the appeal of that toy's novelty.

Carlsmith and I originally reasoned that dissonance through insufficient threat of punishment would produce a long-lasting effect—because the individual himself was induced to derogate the activity. The child ceased playing with a toy, not because someone told him it was not fun, but because he convinced himself that it was not fun. But we did not design our experiment to provide for a thorough test of derogation over time. However, Jonathan L. Freedman has recently produced striking evidence confirming our speculations about the long-lasting effect of a mild threat. In his experiment, he repeated our procedure with minor changes. The crucial toy was by far the most attractive to all the children; it was one of those super-duper battery-powered robots which hurls bombs against a child's enemies. The other toys were trivial by comparison. Freedman forbade the children to play with the mechanical robot, using mild threats for some and severe for others.

After some twenty-three to sixty-four days had elapsed, different experimenters came to the classroom under totally unrelated circumstances to administer a psychological test. They tested the students in the same room that was used by Freedman—the original toys were rather carelessly strewn about. After each experimenter had administered one test to a child, she told him that she would have to score it and might want to ask him some questions about it later—and while he was waiting, if he wanted to, he could amuse himself by playing with some of the toys lying around. The second experimenters, of course, did not know what part each child had played in Freedman's study.

Results clear

The results were clear and exciting. Of 21 children under mild threat, only six played with the crucial toy; of the 21 under severe threat, fourteen played with it. The results are highly significant. The effect of a single mild threat was not only strong enough to lower the attractiveness of a preferred toy, it also was powerful enough to inhibit their playing with that toy as much as sixty-four days later.

The effects demonstrated in these experiments may very well apply beyond mere toy preference, to more basic and important values. For example, a parent might have more success in controlling aggressiveness in a child if he used threats of mild rather than severe punishment. By doing this, he might help the child convince himself that aggression is undesirable and so bring about a lasting change in his behavior. Studies in child development suggest clearly that parents who use severe punishment to stop

s child's aggression do not succeed in curtailing it. In fact, aggressiveness in children increases directly with the severity of parental punishment. The more harshly a parent treats a child, the more aggressive he becomes, at least outside of the home.

On the other hand, although there appears to be no obvious reason why the results of these experiments cannot be replicated using more important value systems, caution is dictated in generalizing beyond the actual data until such replications are forthcoming. Moreover, the practical application of these results hinges upon the subtle problem of finding precisely the correct amount of threatened punishment—a threat which is severe enough to induce momentary compliance and yet mild enough to provide inadequate justification for that compliance. In the experiments described here, 100 percent compliance was achieved with the use of a very mild threat. My guess is that this high degree of compliance was aided by the fact that the experimenters were strangers; children are known not to comply as readily to the requests of their parents as to those of strangers.

Clearly, more research is needed before we can determine whether these techniques can bring about either a more efficient, more civilized society or an Orwellian nightmare.

"I suggest we name it after the inventor—we'll call it 'a nut' "

The supersonic

This is the year the Government gives the green light for the construction of America's first supersonic transport—capable of flying at 1,800 mph. Brig. Gen Jewell C. Maxwell (left), director of supersonic transport for the Federal Aviation Agency, tells what it will mean to the economy, the aeronautics industry and you.

by Victor Block

In light of the technological problems, high cost and other factors, why should the United States develop an SST?

Well, first of all, the supersonic transport, or SST, represents the next logical step forward in commercial aviation. If we don't build it, someone else will. In fact, the British and French have a joint development program underway, and the Russians are building a model of their own.

At stake here is perhaps the richest aircraft market in the history of aviation. Estimates of the market for an American-made SST alone run as high as $20 billion through the 1980s. This is certainly a prize worth shooting for—especially when one considers the impact on our balance-of-payments position.

We expect that the export market for an American-made SST will be about half of the total production. Over a 20-year period, this could result in a gold inflow approaching $10 billion. Add to this figure another $2 or $3 billion which U.S. airlines might spend for the British-French Concord if an American SST were not available, and the total differential or impact on our balance of trade could be $12 or $13 billion.

But more than economics is involved here. The U.S. has set the technological p a c e in commercial aviation for some three decades, and both President Johnson and

President Kennedy have stressed the importance of maintaining this leadership. A strong and healthy aerospace industry is a valuable national asset, and the SST program will help to keep it strong and healthy. In fact, I believe the development of the SST is about the most important program the aerospace industry will undertake for some time to come.

What will the SST mean to the traveler in time saved?

The SST will cut flight times between major population centers of the globe at least in half, and in most cases by more than half.

Will it be able to operate out of existing airports?

The SST runway requirements for both takeoff and landing will be comparable to those of large subsonic jets, so we don't anticipate that any extensive modifications of existing airports will be necessary. Generally speaking, we believe the jet airports of the 1970's should be more than adequate for SST operations.

And since we are on the subject, I might mention that we expect the SST will create less noise problems around airports than current four-engine jets. Our design objectives call for substantial reductions in measured noise levels during both the initial climbout after takeoff and during the approach for landing. A great deal of work has been

(Text continued on p. 64. For a picture album of SST's, turn page.)

Supersonic travel

Pictoral Parade

British-French Concord will take to the air in 1971, or so the European designers hope. It will probably be the first of the supersonics and U.S. airlines have already placed advance orders for 44 of the 14-million-dollar planes. The Concord will speed 120 passengers nonstop across the Atlantic at 1,450 m.p.h., about the top speed possible for a plane built from aluminum, that trusty standard of aircraft production.

Soviet TU-144 is very similar to the Concord and should be in production about the same time, although with traditional secrecy, the Russians have not announced any timetable. The TU-144 will doubtless set the standard for the Soviet bloc nations, but will probably not sell outside of them. Top speed for the Soviet SST is expected to be 1,550 m.p.h. It will be able to carry 121 passengers nonstop for up to 4,000 miles.

Sovfoto

—who's ahead?

Lockheed entry in the U.S. SST race is designed to carry 250 passengers and fly at least 1,800 m.p.h. at altitudes of 10 to 12 miles. It has fixed "double delta" wings, as do supersonic fighters, and a unique swivel nose which lowers for better landing and takeoff vision. Plane will be made of titanium. For heat generated by speed, advanced, and still experimental metallurgical techniques will have to be tested and perfected.

Boeing is designing a plane that will be similar in performance to the Lockheed entry. Most noticeable difference in the Boeing design is the retractable wing, which folds back when supersonic speeds are approached. Both are bigger, faster, more exotic than either Concord or Soviet SST. They are also more expensive and the winner of the Boeing-Lockheed contest will not go into service until at least 1974.
U.P.I.

done in this area, and the results have been encouraging. We have every reason to believe that these noise objectives will be met, and the SST will prove a good neighbor to the airport community.

What is the current status of our development program ?

At the present time, we are two-thirds of the way through an 18-month period of final design work, which should lead directly to prototype construction at the end of this year. Two airframe and two engine manufacturers are competing to build the prototype. Boeing and Lockheed are the airframe companies. General Electric and Pratt & Whitney are the engine companies. All four are working under fixed-price, cost-share contracts which run through the end of the year. The cost-share arrangement is 75 percent government and 25 percent industry.

What consideration will determine the choice of manufacturer to produce the airframe and engine? When will the decision be made?

On September 6, the Government will begin evaluating the final design proposals of the four companies participating in the SST program, with the aim of selecting one airframe and one engine manufacturer to push ahead with prototype construction next January. During this evaluation, we will be looking into both the technical and economic aspects of the competing airframe and engine designs. Safety factors, of course, will be our primary consideration.

In addition, we must satisfy ourselves that the airframe-engine combination we select will develop into a successful commercial vehicle. That is, it must be an airplane that will meet the demanding requirements of the airlines and one that will turn a reasonable profit for them in service. All of these factors will figure in our decision. In answer to your second question, we expect this decision will be announced by the end of the year.

When will the prototype of the U.S. SST make its first flight? When will it begin to operate commercially?

Actually, we plan to build two SST prototypes—both of the same design. The first of these should take to the air late in 1969 or early in 1970 to begin an intensive flight test program. At about the same time, production development should get underway, with the first production model SST rolling off the line early in 1973. We expect to have this aircraft certificated and ready for commercial service by mid-1974 at the latest.

What will it cost to get the first SST in the air?

We expect that the development cost to government and industry

may be as much as $2 billion. This money would see the SST through to certification. In addition, the manufacturers may have another $2 billion tied up in the production line at the time of certification. Thus, the total investment could be in the neighborhood of $4 billion. I should point out here that the Government intends to recover its development investment in the SST with interest if the program is successful.

How will the Anglo-French and the Soviet aircraft compare with ours in terms of speed and passenger capacity? How do their timetables for putting an SST into service compare with ours?

The Anglo-French consortium which is building the Concord has set rather modest goals for its aircraft—a passenger capacity of about 140 and a speed of 1,450 miles per hour. As a result, the Concord is further along the development trail than our SST, which will carry about 250 passengers and cruise at 1,800 miles per hour. The Concord prototype already is under construction and should be flying in the spring of 1968. The production model probably will be certificated and in airline service in 1971—perhaps three full years ahead of our model.

We know very little about the Russian SST, but we believe it's similar to the Concord in terms of payload and performance. It also is in about the same stage of development. The Soviet prototype is now under construction and should be flying in 1968. The production model could possibly enter service with Soviet bloc airlines in 1970 or 1971, but we doubt it will find many buyers on this side of the Iron Curtain.

The Concord, on the other hand, will be a serious competitor. We have every reason to believe it will be a good airplane. However, taking the long view, we expect that the superior performance, larger payload and greater growth potential of our SST will more than offset the time advantage.

We have heard a lot about the sonic boom created as the SST flies along faster than the speed of sound. Can this noise be controlled or alleviated? Will it be harmful or unacceptable to people on the ground?

The sonic boom is a natural phenomenon, like the waves a ship makes as it moves through a body of water. It cannot be eliminated, but it can be controlled.

To begin with, our design objectives for the SST specifically state that the aircraft must have acceptable sonic boom characteristics. This means the boom overpressure levels

produced by the aircraft over land areas must not exceed 2 pounds per square foot during transonic acceleration, and 1.5 pounds per square foot during the cruise portion of flight. These levels represent an increase in normal atmospheric pressure (2,116 pounds per square foot) of less than one-tenth of one percent.

To achieve these acceptable sonic boom levels, each SST flight will be carefully controlled from takeoff to landing. The aircraft will not go supersonic until it has reached an altitude of at least 40,000 feet, and will normally cruise at about 70,000 feet—or twice as high as present-day jets. The SST will fly subsonically within a radius of 100 to 150 miles of its arrival and departure airports.

In regard to the effect of sonic booms on people and property, we can state with a reasonable degree of certainty that the relatively low overpressure levels produced by the SST will not do physical injury to people or damage property. We also believe that people in time will come to accept the sonic boom as they have the rather unpleasant side effects which have accompanied other advances in transportation. These conclusions are based on the results of 11 separate test programs that have been conducted in the sonic boom area since 1958. Additional tests are being planned.

Will travel at supersonic speeds present a health hazard to passengers or crew members?

What about radiation at high altitudes, fatigue caused by time differences between cities, or other foreseen factors?

We don't see any critical problems here. For example, we believe the effect on passengers and crew of flying through several time zones in an SST will not be a great deal different from that experienced during travel in subsonic jets. Moreover, we think a ride from, say, Washington to Tokyo in an SST will be far less fatiguing than making the trip in a subsonic jet.

As for possible radiation hazards, it's the scientific consensus that the levels of radiation at SST cruise altitudes—with the possible exception of solar flares—will not adversely affect the passengers and crew. In the case of solar flares, this phenomenon is predictable and can be indicated by onboard radiation monitors. The SST then will be able to descend to a safe altitude and avoid any danger to the passengers and crew.

Can you describe what SST travel will be like?

SST travel will be disappointingly mundane to most people. There will be no rocket-like acceleration or deceleration, no rapid climbs and descents, and no perceptable shock when the aircraft passes through the so-called "sound barrier." The SST passenger will find himself in a conventional airplane interior which will look much the same as

those of subsonic jets. About the only difference he'll notice in riding the SST is that he will reach his destination much sooner than ever before.

How long will it be before the SST itself is outmoded by a hypersonic transport, or by passenger rockets?

It is only logical to conclude that the SST will someday be superseded by more advanced air vehicles. But these vehicles are still quite a way down the road. We do not have the technology to build a commercial hypersonic aircraft today, and we will not have for sometime to come. I think the SST will remain the standard of commercial air transportation until well into the 1990's, and possibly beyond.

SST will cut travel time in half, but fares will stay the same

With bigger and bigger *subsonic* jets, air fares are expected to drop in the next few years. Pan American World Airways recently ordered 25 Boeing 747's, similar to the current 707 but about twice the size and carrying 490 passengers. The new model, it is estimated, will cut operating costs per passenger mile by about one third (see inside back cover).

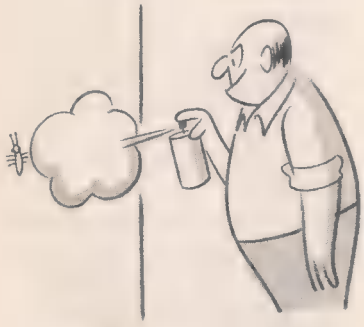
In *supersonic* transports, however, fares are expected to remain at about the present level. The bonus will come in the planes' speed—which will make today's jets seem like lumbering pre-war prop planes.

At altitudes of 10 or 12 miles, the first SST's will cruise at 1,800 mph, later ones will exceed 2,000 mph. At that speed, here's the approximate time it will take to get from U.S. cities to other major cities of the world:

Distance	Hours	Minutes
New York to London	1	45
New York to Buenos Aires	2	45
New York to Bombay	4	00
New York to Melbourne	5	15
Chicago to Mexico City	0	45
Chicago to Paris	2	00
Chicago to Tokyo	3	15
Chicago to Sydney	4	30
San Francisco to New York	1	15
San Francisco to Berlin	2	45
San Francisco to Istanbul	3	15
San Francisco to Capetown	5	00

The above times are based on point-to-point travel at cruising speed. With climbing and approach speeds at subsonic levels, the total elapsed times will be slightly greater.

Son of "Silent Spring"



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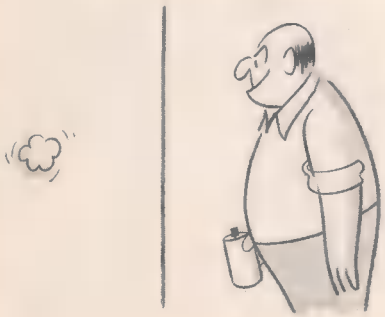

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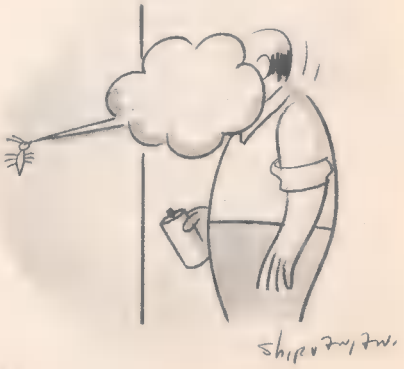


(4.)

If you can't lose weight— what science says

by Joseph D. Wassersug, M.D.

Some persons cannot lose weight no matter how hard they try. For a few, indeed, it is easier to die than to diet. Weight reduction is a more complicated physiological and medical problem than most people realize. How much you eat is definitely *not* the whole answer.

A few years ago, several research-minded doctors put some of their hard-to-diet patients in a hospital and subjected them to a program of total starvation, allowing them only enough water and low-calorie beverages to prevent thirst. For a few days, all went well as patients and doctors rejoiced watching the fat melt away. Then, in some cases, joy suddenly turned to tragedy as the kidneys inexplicably failed to function and deadly poisons accumulated in the blood. By acting promptly, death was averted in most cases but, unfortunately, not in all. Some people, it was discovered, cling to their fat more tenaciously than they cling to life.

The accumulation and storage of fat in the body is an extremely complicated process. One elderly patient of mine—she's 94—loves meat fat, especially the fat on corned beef, and has been eating a fat-rich diet all her life. Yet she is not obese and, at 94, is in remarkably good health. Another patient, age 22, is five feet four inches tall and weighs 242 pounds. She has been dieting since the age of twelve, has been studied at several medical centers, and has steadily grown fatter in spite of diets and reducing drugs.

There is a major and fundamental difference between these two women which, until now, has been only partially explored. When the whole answer is found, the problem of obesity will finally be solved. What clues do doctors have now? What are the important leads?

First, calories do count. Most persons can be starved to slimness. One pound of fat equals about 3,500 calories. If you, the average obese person, eat 500 calories per day less than your body needs, you will lose about one pound each week. If you eat 1,000 calories less per day, you will lose two pounds per week. Weight loss faster than this rate is usually not advisable for many reasons even if it can be achieved. Slow and steady is the rule for

successful dieting. For every dieter, cutting the calories below the body's needs will result in some weight loss.

Misleading charts

Secondly, the standard insurance company height-weight charts that the doctors ordinarily use may be misleading. According to Dr. Carl C. Seltzer, research associate in physical anthropology at Harvard University, more significant is the "ponderal index," which differentiates between degree of linearity (thinness) and laterality (width or heaviness) of body structure. The ponderal index may be obtained by dividing height in inches by the cube root of the weight. For example, a man weighing 135 pounds and standing five feet ten and one-half inches tall would have a ponderal index of 13.7. Generally the higher the ponderal index, the lower the mortality risk.

Dr. Seltzer, who is associated in some of his research with Dr. Jean Mayer of the Harvard School of Public Health, believes that slight or moderate "overweight" by insurance standard tables may show no unusually serious mortality risks. In other words, if you are only a little bit too fat, it won't kill you. The muscular athletic-type he-man may be 25 pounds overweight by standard tables and be in fairly good medical shape, whereas the ordinarily leaner, less muscular type may suffer from as little as a 10 pound gain. It depends more on body structure than on weight alone.

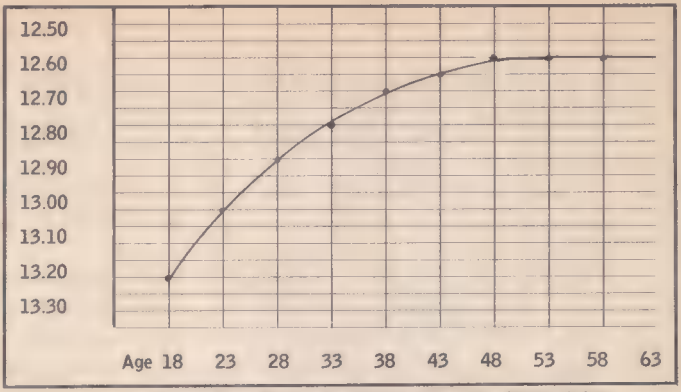
To get the true picture of how "fat" a person is, fat should be measured and not just weight alone. To get some idea of the true fat, one can measure the "skin-fold thickness." This can be done with a special measuring calipers that costs about $70. In youngsters especially, the fat behind the upper arm and below the shoulder blade can be conveniently measured as a thickness of a fold of skin is held between the jaws of the calipers. The reading on the calipers is noted and then compared with standard tables. The fatter the patient, the higher the reading on the calipers. Experience and judgment are important, however, in evaluating the reading. In other words, you can't always tell how fat a person is just by looking at him. You've got to make some measurements.

Nervous regulation

Another problem in dieting lies with the nervous regulation of the appetite center and satiety (sensation of being full) center in the brain. Being "full" after eating is not necessarily the same as not being hungry; the mere absence of hunger is not satiety. While the appetite and satiety control centers are closely related in the nervous tissue of the brain, they are apparently not identical. Hunger does not always cause the same sensations in all people.

(Text continued on page 72.)

How to figure your ponderal index



Atlas of Men, William H. Sheldon, pub. 1954, Harper & Row

The ponderal index expresses the relationship between one's height and one's weight. This curve shows what that is for a normal person at various ages.

BECAUSE standard height-weight charts may be misleading, authorities recommend that you judge your optimum weight by figuring your "ponderal index." To get it, you divide your height in inches by the cube root of your weight in pounds (which you can check in the accompanying table). Thus, if you weigh 175 pounds, you find the cube root to be 5.5934. If your height is 70 inches, you divide 70 by 5.5934 and get 12.52, which is your ponderal index. The higher it is, the better. You can check whether you are above or below the norm by comparing your index with the level for your age in the chart above. If you're 38, you're a little below the norm (note that the ponderal indexes in the chart progress from top to bottom).

	0	1	2	3	4	5	6	7	8	9
100	4.6416	4.6570	4.6723	4.6875	4.7027	4.7177	4.7326	4.7475	4.7622	4.7769
110	4.7914	4.8059	4.8203	4.8346	4.8488	4.8629	4.8770	4.8910	4.9049	4.9187
120	4.9324	4.9461	4.9597	4.9732	4.9866	5.0000	5.0133	5.0265	5.0397	5.0528
130	5.0658	5.0788	5.0916	5.1045	5.1172	5.1299	5.1426	5.1551	5.1676	5.1801
140	5.1925	5.2048	5.2171	5.2293	5.2415	5.2536	5.2656	5.2776	5.2896	5.3015
150	5.3133	5.3251	5.3368	5.3485	5.3601	5.3717	5.3832	5.3947	5.4061	5.4175
160	5.4288	5.4401	5.4514	5.4626	5.4737	5.4848	5.4959	5.5069	5.5178	5.5288
170	5.5397	5.5505	5.5613	5.5721	5.5828	5.5934	5.6041	5.6147	5.6252	5.6357
180	5.6462	5.6567	5.6671	5.6774	5.6877	5.6980	5.7083	5.7185	5.7287	5.7388
190	5.7489	5.7590	5.7690	5.7790	5.7890	5.7989	5.8088	5.8186	5.8285	5.8383
200	5.8480	5.8578	5.8675	5.8771	5.8868	5.8964	5.9059	5.9155	5.9250	5.9345
210	5.9439	5.9533	5.9627	5.9721	5.9814	5.9907	6.0000	6.0092	6.0185	6.0277
220	6.0368	6.0459	6.0550	6.0641	6.0732	6.0822	6.0912	6.1002	6.1091	6.1180
230	6.1269	6.1358	6.1446	6.1534	6.1622	6.1710	6.1797	6.1885	6.1972	6.2058
240	6.2145	6.2231	6.2317	6.2403	6.2488	6.2573	6.2658	6.2743	6.2828	6.2912

Table enables you to check cube root of your weight, so you can figure your ponderal index. If you weigh 175 pounds, find 170 in the lefthand column, then go along that line to the vertical column headed by the numeral 5. That gives you the cube root of 5.5934. To figure your ponderal index, divide that number into your height in inches.

For long-term weight control, you must "re-educate" your appetite.

"Moods, degrees of the urge to eat and preoccupations with thoughts of food are also more complex then hitherto reported," says Dr. Mayer. Furthermore, "whereas hunger is associated with sensations which increase the number and intensity as deprivation progresses, satiety, the cessation of any urge to eat, is not necessarily associated with any characteristic sensation, nor does it simply coincide with the disappearance of hunger sensations." The wise dieter stops eating at the end of a meal even though the urge to eat is not completely vanquished. "Re-education of appetite" is an important objective for those whose goal is long term control of weight rather than haphazard reliance on a so-called "crash diet."

Appestat controls

Near the base of the brain are several clusters of nerve cells, sometimes called "appestats," that regulate the feeding instinct in much the same way that the firing of a furnace is controlled by a thermostat. Whereas the thermostat would react to changes in temperature, the "appestats" regulate blood sugar (glucose). These appestats are infinitely more complicated than thermostats and can be disrupted by head injury and brain damage, tumors, experimental destruction, injection of some gold compounds, and by many other noxious agents.

One of my patients became exceedingly obese (over 300 lbs.) following an auto accident in which he received a head injury that left him unconscious for twelve days. Every effort to take his weight off has failed to date. Even when his father-in-law offered to pay him one dollar for each pound he lost, the attempt to reduce weight failed.

Obesity and asthma

Another patient gained more than 40 pounds after receiving cortisone for asthma, and she has clung tenaciously to both her cortisone and her weight. She refuses to give up her cortisone for fear that her asthma will come back and she would rather have her obesity than her asthma. The cortisone, nevertheless, in her case, has disrupted the brain appestats.

Personality, social factors, genetics and environmental factors also influence the degree of obesity that is considered "acceptable." A Pennsylvania Dutchman said jokingly to me once that in his town all his friends and neighbors were "ten to the ton." Anyone thinner than this would have been considered underfed and deprived. On the other hand, in New York City, a woman's weight can be inversely correlated with her social and eco-

nomic status. The fatter the woman, the more likely she is to come from the lower socio-economic classes.

Theory thrown out

It is now believed that the time-accepted medical opinion that a "low" thyroid condition is a common cause of obesity is probably wrong. The usual metabolism test may be in error when it is used to evaluate extreme obesity. More modern tests, using various blood iodine determinations, are more accurate (if properly done) and can be simply carried out. Some doctors advise routine blood-iodine studies on patients before giving them thyroid tablets. Other specialists still start their obese patients routinely on a modified thyroid preparation (Cytomel) in conjunction with a low-calorie diet. Each obesity problem must be evaluated on its own merits. No one program will be successful in all cases.

It is simple enough to say to a patient, "Eat less and you will lose," but, in the light of modern research, such a statement is exceedingly naive. In a recent discussion of obesity in the *New England Journal of Medicine*, Dr. Mayer lists five major types of obesity in man and then divides the types into more than thirty different categories. This classification includes, of course, some rare types of obesity such as that occurring after frontal lobotomy (for some cases of schizophrenia), and some uncommon endocrine and nervous system disorders.

For some people, apparently, it is as impossible to eat less as it is to grow taller simply because the doctor orders it. Even when they eat as little as they can, they still stay fat.

Another investigator, Dr. Karl E. Sussman of the University of Colorado Medical Center in Denver, lists nine different disorders of metabolism alone in obese persons that have already been described in medical literature. He says, "It has become increasingly apparent that the metabolic abnormalities seen in exogenous obesity are complex. While it remains true that the most common cause of obesity is simply overeating, nevertheless various investigators have demonstrated a wide range of metabolic abnormalities, many of which could contribute to the maintenance of the obese state."

Insulin response

Dr. Sussman studied twelve obese patients in the Clinical Research Ward of the Medical Center in regard to the ability of their blood and tissues to handle insulin and glucose. These patients, he found, "had an excessive insulin response after administration of glucose". Apparently the fat person produces at least an adequate amount of insulin in his pancreas to help utilize the glucose (sugar), but there is a blocking of its utilization in the muscles and other tissues of

the body. It had previously been suspected that obese patients had an insulin deficit and that was why they handled carbohydrates differently from the "normal" person. Dr. Sussman showed that this was not so. Insulin production was normal or even excessive. Giving a fat person insulin injections is, therefore, not likely to help him "burn up" his fat.

Eating less

Calories aren't everything, but they do count. All of us will get fatter if we eat more than our body needs. Most (but not all) of us will get slimmer if we are capable of eating less than our body needs. Most of us possess the capability; a few, apparently, do not.

Some obese persons can be helped by dieting alone, others, by dieting and appetite suppressants. There is a third group who are incapable of being helped because of some significant genetic or metabolic defect. For them, exhortation and nagging about calories is fruitless. They just can't help being fat. Giving them appetite suppressants is costly and usually accomplishes little.

Let us accept these people as they are. Let us not make their lives more intolerable by berating or rejecting them.

"No wonder they never answered their phone."

U.P.I.

Heavy rains triggered this landslide of rock shale and mud in San Francisco's Telegraph Hill area. In some areas at the foot of the hill, debris reached a depth of two stories.

What to do in a landslide

by Eileen Crimmin

IF YOU believe you needn't read this article, consider that scientists rate landslides as one of nature's most destructive phenomena.

A single slide took 3,500 lives in Peru; 106 million cubic feet of earth containing a large section of the town of Surte, Sweden, was slide-dumped into the Göta River; various slides during Panama Canal construction destroyed 200 miles of railroad track, dumped more than 30 million cubic yards of earth into the canal bed; a Norway slide

destroyed a farmer's house and barn while moving his surviving livestock a mile away!

There is no pat formula for surviving a landslide. Those who've experienced one equate their escape with luck, God or fate. It's a lap-of-the-gods situation.

Take flight

Survivors caught without warning speak of "grabbing a tree" or "riding some junk through the mud" and of "being thrown up on some kind of wood while things went flying by on both sides."

Anyone given reasonable warning of a slide by sight or sound is advised that headlong, streaking flight out of its path is the only action worth taking.

But what of tourists camped in a national park who were engulfed at night? Who knew where the slide originated or where it was going?

What about the breakfasting home owner whose house suddenly escalatored downward as it came apart at the seams?

What about the businesswoman who was cleaning the living room in her rented apartment when, with a dull roar and violent tremble, there like magic were both back bedrooms filled with mud?

As a secondary reaction, most of these citizens escaped. Had each used reasonable knowledge and foresight, some might not have been there in the first place.

Your real problem with landslides is that you are there. Your best salvation is not to be there. This requires understanding of the terrain and conditions which precipitate slides.

Landslides result from one basic problem. Two or more strata of earth and/or rock do not adhere to one another. However, this alone seldom causes slippage.

Add to lack of adhesion some water to lubricate or emulsify the layers, or a quake or explosion to disturb the balance of weights and pressures, and you set the scene for slides.

Any civil engineer can test-bore property and offer its normal slide quotient. But nobody can foretell a property's slide rating under abnormal conditions like torrential rains, rapid thaw of heavy snowpack, destruction of vegetation by fire or land clearance, or weather erosion.

Although earth cliffs everywhere have remained at 90 degrees vertical for centuries, land above the infamous "quick clay" can slide on a slope of less than one degree!

Preventive measures

Landslide safety lies in preventive reasoning. When building a home, get your city engineering department's report of the earth structure of the entire neighborhood, possibly the entire county.

Temper eagerness for view with prudence. A broad hilltop is safer than its ascending flanks. The literary man's dream "brow of the hill" can be a contractor's—and its

If you hear or see a slide coming, the only thing worth doing is to run.

occupant's—nightmare.

Even the "house founded upon a rock" is a safer allegory than structure. Deep, wide and lengthy rock strata are known to split away to send homes and whole communities to oblivion.

When renting, check basements for cracked walls and floors. If newly repaired and painted, eyeball window and door casings for a level set. If they're off level, worry. Inspect the neighborhood for displaced street slabs, cracked yard bulkheads, fractured retaining walls, tilted power and phone poles. All give clues to earth movement that can develop within the life span of the various structures.

Dangerous scenery

Be wary of ravine sites. Most were formed by water flow or seepage wearing down a soft, mobile earth. The steep glens and glades are picturesque and peaceful but inadvertently may become your final resting place.

When traveling, it's part of the game to lodge at cliff-top hotels or anchored-in-rock motels where views are spectacular, wind eerie and memory worth telling relatives. Sometimes these structures do fall into the ocean or valley below. Consider the possibility, then do as you please.

When you are camping, your safety is strictly your responsibility. Even though most private, state and federal campgrounds are chosen with tourist safety in mind, inspected regularly and closed at first hint of danger, who is infallible in such matters?

So make it policy to avoid deep ravine and sheer cliff campgrounds. Be wary of stream-bank campsites. Bunk beside swollen streams at your peril. Think twice about tenting below cliffs, especially those that are oozing moisture or lacking vegetation.

For maximum camping safety, inspect all surrounding territory from horizon to horizon. The lay of the land tells much about itself with rock-slide scars, old timber slides, dry gorges indicating possible sudden shift of river bed, and so on.

Wherever you are, keep alert for signs of mudslides. Unless a quake or explosion starts a dry earth slide, most occur during or after rain. Even a tiny trickly slide indicates trouble.

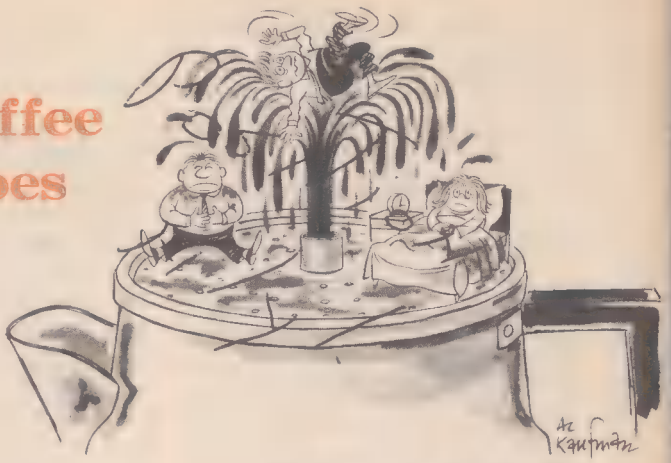
In slide-prone areas of Sweden, for example, the smallest mud displacement signals evacuation of families. In hilly U.S. cities like Los Angeles, San Francisco, Portland and Seattle, the movement of wet topsoil sends residents to relatives or motels for one or several nights.

In more ways than one it pays to live life on the level.

Super roadblock

THE sign on the truck said, "Caution, Wide Load." It was a classic understatement. The load was the widest and heaviest one ever to move across California highways. What was it? A giant test tank simulating the S-11 second stage of the Saturn V moon rocket. The test tank is 47 feet long and 33 feet in diameter and when this picture was taken, it was being moved 110 miles to a laboratory at Santa Susana. To make the trip, the tank had to be pushed onto its side and mounted on a specially-built transporter. The overall length then came to 120 feet, the height to 43 feet and the gross weight to 200,000 pounds. Width was canyon wall to canyon wall.

What coffee really does to you



by Dr. Irwin Ross

Is coffee harmful? Does it really unstring your nerves, give you indigestion, spoil your sleep, hurt your heart and blood pressure? Can it stunt your children's growth?

These are not just academic questions. For, according to a nationwide survey by the Pan American Coffee Bureau, 96 percent of the families in the U.S. drink coffee every day. Eight in ten adults drink it daily; so, amazingly, do one in four children. We are consuming on the average of 50 percent more coffee today than we did 10 years ago—in fact, an ambitious statistician figured out recently that we drink annually a billion more gallons of coffee than milk; four times more coffee than beer; three times more than soft drinks; 50 times more than hard liquor.

If coffee is harmful, we, the people, are doing ourselves a staggering amount of harm and should know about it.

Caffeine, the essential ingredient of coffee, is a poison. A drop injected into an animal's skin will kill it within a few minutes. An infinitesimal amount applied directly to your brain would send your body into uncontrollable convulsions. Injected into your muscles, it would paralyze them.

When you swallow the caffeine in coffee, none of these disasters occurs, because most of the caffeine goes straight to the kidneys and is promptly excreted.

But when you drink even one or two cups of coffee, startling things do happen inside you:

Within a few minutes, the temperature of your stomach jumps 10 to 15°, and there's an increase of up to 400 percent in its secretion of hydrochloric acid. Your salivary glands double their output; your heart beats 15 percent faster; your

lungs work 13 percent harder. Blood vessels get narrower in your brain, wider in and around your heart. Your metabolism rate goes up to 25 percent; your kidneys manufacture and excrete up to 100 percent more urine.

Caffeine content varies

Every coffee drinker doesn't react exactly the same way, since there are wide individual differences in caffeine tolerance. A lot also depends on what kind of coffee you drink. If you drink it black and without sugar, your system will be affected considerably more than if you take it sweet and light. If you prepare your coffee by boiling it, you ingest 10 percent more caffeine than if you use a "drip" pot. Percolator coffee has slightly more caffeine per cup than "drip" coffee.

Moreover, different brands of coffee differ widely in caffeine content. Most less expensive brands are made chiefly of Brazilian coffee, which contains more caffeine than the Central American or Mexican coffees which predominate in higher-priced brands.

If you drink de-caffeinated coffee, your heart, kidneys and metabolism won't be affected. However, your stomach will be affected about as much because the stomach responds not only to caffeine but to caffeol, the volatile oil in coffee which gives it its unique flavor and aroma. (Caffeine has no flavor or smell, and coffee tastes the same whether the caffeine is in or not.)

No matter what kind of coffee you drink, its short-range effects usually begin to wear off within half an hour. The stomach is first to get back to normal; then the heart and blood vessels; finally the glands and metabolism.

The first comprehensive research on the long range effects of coffee was conducted at the insistence of the coffee industry. In the 1920's, the industry turned over $22,500 to the Massachusetts Institute of Technology, and Dr. Samuel C. Prescott, then head of MIT's biology department, conducted a three-year investigation. In his final report, Dr. Prescott said: "Our search fails to bring to light any important or convincing evidence . . . that coffee is prejudicial to the health of the general public. . . . When taken in moderate amounts, it is not in the least deleterious . . . or followed by undesirable after-effects. . . . However, a small percentage of the population—probably not more than one percent—responds unfavorably to caffeine stimulants . . . and cannot use coffee without unfavorable results."

Stomach upset

That was over 40 years ago. The question now is: Do doctors today agree that the vast majority of us can drink coffee without hurting ourselves?

Consider, first, what has been found out since Dr. Prescott's investigation about the effects of coffee on the stomach. Dr. L. J.

Does coffee cause ulcers? No one knows. But it can cause stomach pain.

Meduna, of the University of Illinois, in 1962 observed the stomachs of a large group of medical students. In 95 percent, caffeine caused a sharp rise in hydrochloric acid, and then a swift return to normal. But the stomachs of the other five percent did not return to normal. Moreover, nearly all of these developed serious stomach trouble, even ulcers.

At most ulcer clinics, patients today are limited to one cup of weak coffee. However, I found no doctors who feel that it has been conclusively demonstrated that restricting coffee can prevent ulcers, nor that you will surely develop ulcers even if you consume large quantities of coffee.

But coffee does cause other types of stomach pain. In 1948, Dr. Philip Hawk of New York had several hundred young non-coffee drinkers drink two to six cups of coffee daily for months. Fifty percent complained of painful "burning" in the pits of their stomachs, nausea or flatulence. As soon as they stopped drinking coffee, their stomachs felt fine.

Just how coffee causes stomach upset is not known. Some doctors maintain the trouble is caused not by the coffee itself so much as by the cream and sugar that are usually taken with it. In a lengthy series of experiments, it was found that when cream and sugar are taken after a meal, they may interfere with the digestion of other foods and may stop digestion altogether for several hours.

But in Dr. Meduna's studies, he found that coffee is more likely to upset the stomach if taken without cream or sugar.

And at Western Reserve University, researchers recently found that it is the caffeol in coffee which deranges digestion, while researchers at the University of Oklahoma have found that caffeol has a definitely soothing effect on the lining of the stomach.

Confusing? Of course, but at any rate, I could find no doctor who agrees that coffee is an aid to the digestion, the theory that was popular some 40 years ago.

Helps circulation

Can coffee hurt the heart? Some doctors say that nobody with heart disease should drink coffee, but there is no proof that coffee in moderation hurts the average cardiac patient, if he is accustomed to it.

There is some evidence, however, that one type of heart disease—coronary thrombosis—may be aggravated by coffee. But on the other hand, coffee may even be beneficial in other kinds of heart disease—particularly in congestive heart failure, where the circulation is sluggish and the heart weak.

That's because caffeine strengthens heart action and stimulates circulation. Caffeine pills or injections are often used by doctors as heart or circulatory stimulants.

Does coffee make you nervous? Scientists, today, agree that most habitual coffee-drinkers are not made nervous, even if they drink large amounts of coffee. In fact, if you drink too much coffee, it's likely to make you listless.

Aids energy

Is coffee really a stimulant? The National Office Management Association reports that in three out of four offices, employees are encouraged to take time out each morning for a cup of coffee—because coffee is supposed to pep up employees from any mid-morning slump. Recently, the Connecticut State Highway Commission recommended that night drivers be given free coffee along the road, on the grounds that coffee should keep them alert and prevent accidents. At Northwestern University, researchers found that after taking caffeine, subjects could do twice as much work as usual without getting tired. Studies at Columbia University have shown that coffee can increase typing speed and can enable you to solve problems faster.

However, equally authoritative tests can be cited to prove that all mental stimulation ceases if you consume more than two cups of coffee.

Some three million people now drink de-caffeinated coffee because they fear regular coffee will keep them awake. Two out of three coffee-drinkers never take any in the evening, for the same reason.

But Dr. Leo Stanley, when he was prison physician at San Quentin, found that men who drank one cup of coffee before retiring slept better than men who did not drink coffee. However, those who drank two to three cups of coffee did have difficulty falling asleep and often had nightmares.

In the late 40's, Dr. Nathaniel Kleitman of the University of Chicago—recognized as the foremost authority on sleep in the country—stated that it takes at least two cups of coffee to spoil the average person's sleep. Dr. Kleitman also tested the popular belief that if you think coffee will keep you awake, it will. For most people, he said, that's not true. In his tests, he gave his subjects caffeine pills, and alternated these (without telling) with pills containing milk and sugar. Just one of his subjects spent a sleepless night, and that was after taking milk and sugar pills.

Children as consumers

When 200 pediatricians were asked whether it's safe for children to drink coffee, only one said there was no reason why not. A handful said it's all right to flavor children's milk with coffee. All the rest said "no coffee."

According to the Pan American Coffee Bureau, one in four young-

Doctors find coffee handy for fighting deadly poisons and asthmatic attacks.

sters drinks coffee regularly. Right now, the promotional agency for South American coffee exporters is working to build up coffee consumption among youngsters. Their chief argument is that most children drink plenty of other beverages containing caffeine, so why shouldn't they drink coffee? (According to tables compiled at Northwestern University, coffee contains somewhat more caffeine than other caffeine beverages. One cup of coffee has 100 to 120 mg. of caffeine. A bottle of Pepsi Cola contains 77 mg. A bottle of Coca Cola has 33. Tea contains 17-33.)

Despite doctors' disapproval of coffee for children, it has never been conclusively proven that coffee stunts their growth or endangers their health.

Several years ago, Dr. Lloyd F. Craver of New York made a study of stomach and esophagus cancer patients at Memorial Hospital. He found that one in four had been in the habit of drinking very hot beverages. Dr. Morris K. Barrett, ex-senior biologist at the National Cancer Institute, once stated that stomach cancer is very rare in animals and very common in man. Studies show that there is much more gastric cancer in the U.S. than in England, where most beverages are drunk lukewarm.

Most doctors recommend that excessively hot drinks be avoided, as a preventive measure against throat or stomach cancer. But they state emphatically that there has not been any conclusive evidence that hot coffee does cause cancer.

On the other hand, there is evidence that hot coffee can alleviate migraine headaches.

As a matter of fact, doctors have found that coffee has a variety of medical uses. Eye doctors utilize it in diagnosing glaucoma, a serious eye disease which afflicts 1,500,000 people. (If a glaucoma victim drinks a cup of coffee, his eyes show characteristic symptoms.) Coffee is also one of the most effective antidotes to deadly poisons, particularly morphine and lead. It can also relieve asthmatic attacks—and, of course, it's a heart stimulant.

When you total the score on coffee, do its bad effects outweigh the good? Undeniably, medical research has proved that for some people coffee is dangerous and should be avoided completely. But for most people, three or four cups a day seemingly lead to no injury.

Right now, however, 25 percent of coffee-drinkers are drinking five or more cups daily. Maybe nothing serious will happen to them if they continue to consume this excessive amount. Maybe they are harming themselves seriously.

There seems to be plenty of evidence to support whichever theory you may want to pick.

THE HUGH DOWNS COLUMN

How to speed up time

DOES time really fly? Or is it, as Shakespeare said of that never-arriving tomorrow, that it "creeps in this petty pace" . . .?

Perhaps we should first ask ourselves whether time exists.

This question has been considered seriously by many philosophers. Briefly the doubt comes about this way:

If the future does not yet exist and the past no longer exists, and if the present is only a dimensionless boundary—that point between the past and the future—then the present has no beginning and no end and nothing with neither beginning nor end can be said to exist.

If that is so, time in all its forms collapses completely, a very embarrassing thing for manufacturers of calendars and clocks, not to mention designers of installment purchase plans and composers of railway and airline timetables.

St. Augustine advanced this idea, kicked it around for a while and finally gave up on it. St. Thomas Aquinas got a little deeper into it and concluded that God, as active cause of the world, need not necessarily "be prior to the world in duration, because creation, by which He produced the world, is not a successive change." And although he was one of history's great reasoners, Aquinas concluded that this puzzle can't be solved by reason.

"The newness of the world," he wrote, "is known only by revelation. . . . That the world did not

always exist we hold by faith alone; it cannot be proved demonstratively."

Aquinas easily anticipated later statements of the difference between being and existence such as Santayana's, by writing, "As eternity is the proper measure of being, so time is the proper measure of movement; and hence according as any being recedes from permanence in being, and is subject to change, it recedes from eternity and is subject to time."

Kant, obsessed with the possibility of *a priori* forms of intuition, denied an independent reality to time, and in effect returned to the argument that it can't exist. So we're back to Augustine, who felt that time is the extendedness of the mind only. Since neither past nor future exists, he reasoned, neither can be measured. Only the passage of time can be, as we can measure it only in the mind.

Jamesian solution

This makes subjective time more real than any concept of an absolute time, but leaves us still at sea with regard to the reality of the present moment.

It wasn't until William James proposed a solution to the mystery of how subjective time exists that we got any hope of escape from this bind. So far as our experience goes, both the past and the future can exist only in the present. But the present, according to James, is not that infinitely thin boundary between past and future. When he calls the "specious present" (which is the present in terms meaningful to human experience) is the unit of composition of our perception of time and it has a duration. It also has a direction, as though it possessed a bow and a stern.

Present varies

Some experimental evidence gathered by James estimates that the specious present may vary in length for different individuals and for the same individual at different times, but that it varies from a few seconds to probably not more than a minute. It has "a vaguely vanishing backward and forward fringe; but its nucleus is probably the dozen seconds or less that have just elapsed."

This is shown in part by (or perhaps helps to show) two distinct types of human memory. One is sequential and the other referential and selective.

Try this: Recall what you were doing immediately before reading this article. Then what you did before that, and before that and before that. At some point in the recent past, you will be unable to be certain of what event took place. You have been recalling in sequence, walking as it were from the memory of one event to that of an immediately adjacent one.

Now think for a moment of something that happened to you in your childhood. That memory can be clear and definite. But it does

The secret seems to be that time speeds up the less conscious you are

not require recalling everything that happened to you since. This is a different kind of memory. If you repeat someone's name immediately after hearing it, you can do so because the sound lingers in the specious present—it echoes in the mind. But if you see him and call him by name a month later or five years later, you are using recall based on association. It is a recall independent of sequence. This is extremely complicated in the crossfiling aspects involved.

Take the memory of the name Albert Einstein. It is filed in my mind in many ways. First, it's filed with any recognizable picture of him which I might be shown and asked to identify. Second, if someone said, "Name some great physicist," I would find Einstein's name filed in my list. If I were asked why I planned a trip to Princeton in 1954, I would remember that it was in the hope of meeting Dr. Einstein. (In this case, the process of recall may be very complicated, involving sorting through all memory bits contiguous to the concept of "Princeton," one of which would be Einstein, plus sorting a flood of personal memories and hopes that would somehow lead to the remembered idea of travelling to Dr. Einstein's house to talk with him—whatever was dredged up here would be used to reinforce the other evidence, and finally the whole mess re-filed with the memory of having been asked the question!)

This non-sequential memory, though not precise in its recall of elapsed time, does carry with it at least a rough idea of date. While you might reverse the order of two events that took place in the same week ten years ago, you are not likely to reverse the order of your first haircut and your wedding night.

This dating process, as well as sequence remembering, may be possible because of what James calls the specious present, which allows us an idea of the direction of time, and sets some sort of finite rate on its passage.

The specious present, too, may be the key to the bond between consciousness and subjective time. If it is, then it can be demonstrated that, in diminished consciousness, time does not slow up but speeds up!

Conversely, in heightened consciousness, time "slows down" and allows the participant a more deliberate basis for experiencing each detail of existence. Reports (for whatever they're worth) from people who've undergone experience with mind-widening drugs indicate that expanded consciousness is associated with or characterized by this flavor of slowed time. The Zen

Buddhist experience of *satori* or enlightenment (a kind of superconsciousness) is often said to convey a time passage rate so slow that the eternity inherent in a single moment can be sensed.

Let's look at it another way:

If you sleep poorly, that is, if you retain consciousness, the night will seem as long as the clock says it is. But if you sleep well, an eight-hour night may seem to have passed in a couple of hours. If you sleep very soundly, it may appear to have gone by in even less time. In other words, the rate of passage of time seems to have speeded up as consciousness is diminished. Under heavy anesthesia, where consciousness is severely depressed, a patient may think on awakening, after a five-hour operation, that only a few minutes (or in some cases a few seconds) have gone by.

If we carry this one step further, we'll see that consciousness has a profound comment to make on itself. And it relates to its intimate connection with time:

Consciousness is

If consciousness is depressed to the point of non-function, then an eternity passes in no time at all. There is, indeed, no death, at least in the sense of oblivion, since the concept of oblivion is self-contradictory, appearing to require a continuing state of *un*-consciousness. This is the same as requiring an entity to (1) *be un*-conscious and (2) record, through the passage of

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time, its own *un*-consciousness.

The idea of time's passing at any rate whatever requires some sort of consciousness of the rate of passage. So we see that if consciousness is dependent on a concept of time's passing (or moving or existing through duration), then any idea of its passing or existing is dependent in turn on consciousness. Hence consciousness *is*.

To re-state: Diminishing consciousness, as it approaches the vanishing point, seems to eat up time in greater and greater quantities until eternities glide by in nothing flat. On the other hand, expanding consciousness, as it approaches some sort of totality, slows down time's rate until it finds whole eternities in single moments.

Whether or not these extrapolations hold in the extremes, at least each of us can find evidence of this idea on a limited scale in our daily lives. Time doesn't always seem to pass at the same rate. It can be affected by fever, by sleep, by drugs, by aging. (The decade between age forty and fifty seems a good deal shorter than the one between age ten and twenty—it may not have passed more quickly as it was going by, but in retrospect it seems to have passed more quickly.)

"What I feared has happened. My firm didn't replace me with a computer, but with a kid out of high school"

The fabric of time

Consciousness thus shows itself to be so much of the fabric of time that it cannot cease to be. When it is shut down entirely by death, while it may not transfer for continuance the memory elements that make for integrity of personality, neither will it suffer any conscious animal to 'be' dead.

And—come on, let's go into the really deep water—time is so much cut of the cloth of consciousness that the universe, e i t h e r unconscious or infinitely superconscious or in some way both, does not concern itself with such artificial distinctions as duration or past or future or the present moment.

What causes the idea of time passing? We do. We are the creeps in this petty pace.

QUIZ

A painful subject

by John and Molly Daugherty

PAIN can be good. It gets you to the doctor on time and helps him make a correct diagnosis.

Before the discovery of anesthesia, the best surgeon was the fastest operator! One such surgeon, Robert Liston, could amputate a leg at the University College Hospital in London in 32 seconds. But today an operation can last for hours without your feeling any pain.

Aside from the fact that every man has had it, what do you know about pain?

1. Your threshold of pain is
   a. Significantly different from that of a person of another race
   b. Extremely different from that of the opposite sex
   c. About the same as that of everyone else
2. The laboratory measures pain in dols with a dolorimeter. Two JND's—just noticeable differences—equal 1 dol of pain. You can distinguish about 21 or 22 pain intensities. On the pain scale from 1 to 10 dols, if childbirth registers 10 dols, your guess for stomach ulcer is
   a. 2—3.5 dols
   b. 4—6 dols
   c. 0.5—1.5 dols
3. The brain itself, which registers and analyzes pain impulses, is
   a. Insensitive to pain
   b. Exquisitely sensitive to pain
   c. Moderately sensitive to pain
4. A local anesthetic first blocks out
   a. Deep pressure
   b. Cold and warmth
   c. Pain
5. If you step on a tack with your bare foot, your brain registers pain in about
   a. 1/5th of a second
   b. 1/100th of a second

c. One second

6. **Your emotions, intelligence, will-power, memory, religion, cultural background, and so on, affect your reaction to pain. Your reaction may vary greatly from time to time, and it may vary greatly from that of another person to the same amount of pain. Tolerance of injury is least in a**
   a. Worm
   b. Rabbit
   c. Man
7. **Itching is transmitted by**
   a. Nerves different from those that transmit pain
   b. The same nerves that transmit pain
   c. Nerves different from those that transmit tickling
8. **The drug most widely used to relieve pain is**
   a. Opium
   b. Aspirin
   c. Morphine
9. **A stiff drink can raise your threshold of pain above normal by as much as**
   a. 10 percent
   b. 40 percent
   c. 87 percent
10. **Morphine acts on the brain to relieve pain, but local anesthetics, by blocking the nerve impulses before they reach the brain, act at the spot where the pain originates. The first medical use of cocaine as a local anesthetic was in**
    a. Tooth extraction
    b. Eye operations
    c. Spinal anesthesia

Answers:

1—c About the same as everyone else's pain threshold. According to research, there's just no appreciable difference. Most people perceive pain when their skin temperature is exactly 45° C., and nearly everyone perceives it before his skin temperature reaches 47° C.

2—a Stomach ulcer pain measures 2 to 3.5 dols. A headache ranges from 0.5 to 1.5 dols—in case you want to compare your migraine with your mate's ulcer! A coronary thrombosis is from 4 to 6 dols of pain. Major surgery and childbirth are 10 dols each. (Incidentally, in some tribes, the pain of the woman during childbirth is said to be transferred to her husband by hypnotism!)

3—a Insensitive to pain. A surgeon can cut and cauterize the brain itself while the patient is fully conscious. The stretching of blood vessels and membrane inside your skull and the stimulation of your scalp muscles cause your head to ache. But your headache isn't brain ache.

4—c Pain. Then cold and warmth, touch and deep pressure.

5—a One-fifth of a second. Although the tack is in your foot, you register and interpret the injury in your head before you feel it in your foot. A chemical transmitting substance stimulates the injured nerve endings, and the impulses pass along your sensory nerves from 0.5 to 100 meters a second. Both fast and slow nerve fibers carry pricking pain. This fact accounts for the double-take of pain after stepping on the tack. You have almost instant pain first and then a second pain, perhaps more intense, after a delay.

6—c Man. Pain is one of the prices he pays for being a man instead of a worm or a rabbit! A worm has only reflex action to injury. A lower animal without a cortex may suffer pain through the thalamus, but it

won't suffer from memory or apprehension of pain. Man, as well as his fellow primates, feels pain because he has more "grey matter."

7—b The same nerves that transmit pain. They also transmit tickling. Burning, pricking and aching are the three types of pain. Itching combines two of the three—burning and pricking—but at a much lower intensity than pain.

8—b Aspirin. Billions of tablets containing aspirin are sold every year. The way in which aspirin relieves pain is still unknown, for research hasn't proved it raises your pain threshold. Morphine and opium do.

When you have fever, aspirin lowers your body temperature but doesn't affect the disease causing the fever. We use it mainly to relieve the pain of headaches, neuralgia, rheumatism, muscles and joints—pains of low intensities.

9—b 40 percent. But there are psychological effects. Alcohol is a depressant—not a stimulant. Like morphine and the opiates, it affects both your perception of pain and your reaction to it.

Alcohol has been used as an anesthetic in war emergencies, but the amount needed is almost enough to cause coma. Hypnosis has also been used for operations by prisoner-of-war surgeons and psychiatrists on fellow prisoners of war.

10—b Eye operations. The Incas of Peru chewed coca [not cocoa] leaves to relieve pain. They applied the chewed leaves to wounds. Some of these leaves were taken to Germany, where, in 1860, Niemann, an assistant to the chemist Wohler, extracted the crystalline substance cocoaine, the active ingredient of the coca leaf. Not until 1884 was cocaine injected under the skin as a local anesthetic in an eye operation. By 1885 it was used in tooth extractions, and later on, in spinal anesthesia.

Score yourself:

9—10 right—You should be tickled to death!

4— 8 right—Your score isn't a pain in the neck.

0— 3 right—You may not know that "pain is a sensory modality in search of a sense organ", but you know when you've got a pain—and that's good enough.

"What with Daddy a warlock and Mommy a crone, how could I miss?"

PLEASE EXPLAIN

Mt. Wilson and Palomar Photo

Why does the moon show only one face?

Although the moon rotates about the earth, it keeps the same side oriented toward the earth. How did this come about?

The gravitational attraction of the moon upon the earth raises the ocean on both sides of our planet, making two tidal bulges. As the earth rotates from west to east, these two tidal bulges, always facing toward the moon in one case and away from it in the other, move around the earth from east to west.

As the tidal bulges move around the earth, they scrape against the bottom of shallow seas such as the Bering Sea and the Irish Sea. This scraping sets up friction which converts energy of rotation into heat. Very slowly, as the earth's rotational energy is consumed in this manner, our planet's movement about its axis is slowed. The tides act as a brake on the earth's rotation and, in consequence, our days are getting one second longer every thousand years.

It isn't only the water of the ocean that lifts up in response to the moon's gravity. The solid crust of the earth also responds, though to a less noticeable extent. Two small bulges of rock circle the earth, one bulge facing toward the moon and the other on our planet's opposite side. As the bulges of rock

move about the earth, the friction of rock layer against rock layer also bleeds the earth of its rotational energy. (The bulges don't move bodily about the planet, of course, but as the planet turns, the bulge subsides in one place and forms in another, as different portions of the surface pass under the moon.)

The moon has no seas and no ordinary tides. However, the solid crust of the moon responds to the earth's gravitational force—and the earth's gravitational force is 80 times as large as that of the moon. The bulge drawn up from the moon's surface is much larger than the one drawn up on the earth's surface. The moon would therefore be subjected to considerably more tidal friction than we are, if it were rotating in a twenty-four hour period. What's more, the moon, with a much smaller mass than earth's, would, for an equal period of rotation, have a far smaller total rotational energy to begin with.

As the moon's smaller initial supply of energy is bled off more rapidly by the large bulges formed by earth, its period of rotation would decrease at a comparatively rapid rate. Many millions of years ago it must have slowed to the point where the moon's day became equal to its month. Once that point was reached, the moon would always face one side to the earth.

That, in turn, freezes the bulges into position. One bulge would always face us in the very center of the side of the moon we see, and the other would point away from us in the very center of the side of the moon we don't see. Since those sides don't shift position as the moon revolves about us, there is no further motion of the bulges and no further frictional effect to alter the moon's rotational period. The moon will therefore continue to face one side toward us indefinitely —and, as you see, this is no coincidence, but an unavoidable effect of gravitation and of friction.

The moon is a comparatively simple case. Under some circumstances, tidal friction can produce more complicated conditions of stability. For some 80 years, for instance, it was thought that Mercury (the closest planet to the sun and the one most strongly affected by the sun's gravity) kept one face to the sun for the same reason the moon keeps one face to the earth. Actually, it turns out that in the case of Mercury, frictional effects are able to produce a stable period of rotation of 58 days, which is just 2/3 as long as Mercury's 88-day period of revolution about the sun.

—Isaac Asimov

Address your questions to Please Explain, Science Digest, 1775 Broadway, New York, New York, 10019.

What is arthritis? Is there a cure?

The word "arthritis," strictly speaking, means an inflammation of a joint, according to the Arthritis

Foundation. However, the word has become a popular name for a number of conditions that cause aching and pain in and about the joints, regardless of the underlying causes.

The most common forms of arthritis are rheumatoid arthritis, ankylosing (joint-stiffening), spondylitis (inflammation of the vertebrae), osteo-arthritis, rheumatic fever and gout. Rheumatoid arthritis causes the most concern and can strike at any age. It is the most painful and the most crippling. It is a chronic, inflammatory disease, primarily of the connective tissue that affects the entire body. It can produce disease of other organs, but its most usual point of attack is the joints and the tissues around them.

No one knows what causes rheumatoid arthritis. Some scientists believe it may be due to an infection of some kind. Many think it is caused by a derangement of the body's own defense mechanism. Neither theory has been proved. It also seems clear that tension may be an important factor in aggravating the disease in certain individuals. Conversely, alleviating emotional stresses seems to bring about improvement.

There is no medical cure for rheumatoid arthritis, but serious crippling can be avoided in almost all instances, provided treatment is started early and is continued faithfully. Sometimes, the disease is very mild.

Many techniques can be used in treatment. Proper rest and exercise, supportive treatment, salicylates (aspirin), selected drugs and sometimes corrective surgery are all part of a successful program. Besides aspirin, which has a very special and helpful effect in rheumatoid arthritis, these other drugs are used in treating the disease:

Chemical compounds containing gold, which can reduce the severity of inflammation and sometimes, authorities believe, even change the course of the disease; *cortisone and related compounds,* which have a powerful and dramatic effect by reducing inflammation but are prescribed less frequently today (for complete control of symptoms, they have to be given in doses that cannot be tolerated well or are unsafe); *phenylbutazone,* a modern drug that may reduce inflammation temporarily; *antimalarials,* derivatives of quinine, that tend to the reduce the symptoms, especially when prescribed over a long period of time; *indomethacin,* which can be prescribed for long-term treatment, with relatively minor side-effects.

LETTERS TO SCIENCE DIGEST

Fascinated by Downs

I enjoy most of the articles in *Science Digest*, but I am especially fascinated by "The Hugh Downs Column." I don't know whether he has an incredible knowledge of science, spends most of his time doing research or both. Although he sometimes loses me after the fifth or sixth paragraph, I usually find his articles very engrossing.

I'd like to congratulate *Science Digest* on presenting facts to its readers, not just trying to peddle its own opinions.

JACK L. WISECARVER
Piedmont, Mo.

Contamination of planets

Recently the Soviet probe, Venus 3, plunged into our sister planet. There was considerable speculation as to the possible contamination of Venus because of this. Based upon what man knows positively about the atmosphere of Venus, it appears highly unlikely that the Soviet spacecraft ever came near the surface of the planet. The probability that Venus 3 and any microorganisms she may have carried were burned out of existence as the spacecraft hurtled through the dense atmosphere of the planet should allay any fears about contamination.

There is, however, great reason to fear such a contamination of the planet Mars. The Soviets' Zond 2, with which radio contact has long been lost and which may crash into

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Develop A Powerful Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply be remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this paper with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new book, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Simply send your request to: Memory Studies, 835 Diversey Parkway, Dept. C78B, Chicago, Ill. 60614. A postcard will do. Please include your zip code.

Mars, justifies our deepest anxieties about such contamination. Despite the bleak picture that our historic Mariner 4 probe painted of Mars, there is absolutely no reason to believe that Mars contains no life forms, or that the Martian environment would not be congenial to the rapid proliferation of earth germs. The fact that, according to information radioed to earth by Mariner 4, the Martian atmosphere would present no impediment to a "crash landing" lends greater weight to these fears.

RUSSELL G. LANZAR
New York, N.Y.

Drop a line

I have been an avid reader of your magazine for quite a while and have throughly enjoyed every issue. I thought I would just drop you a line to tell you that I think you are the most up-to-date magazine around.

STUART EHERSKOV
Downsview, Ont.
Canada

Another explanation

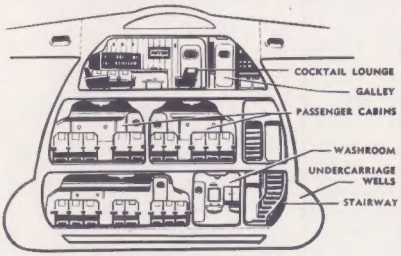
There's another explanation to the question of why all the planets are in nearly the same orbital plane, besides the one given by Dr. Isaac Asimov (Please Explain, April, '66).

Over a period of many millions of years, the mutual gravitation of one planet on another would do the job. In addition, it would slowly make more circular a highly elliptic orbit of a recently captured planet, which would be growing, in the meantime, by accretion. Comets may be planets in a very early stage of development.

WILLIAM T. THOMAS, JR.
Daytona Beach, Fla.

Photos: Pictorial Parade

Above: Model of Boeing's proposed 747 compared with current Boeing 707 airliner. Right: View of the planned 902-seat Lockheed C5A shows three decks.



New giants of the sky

By the 1970's, anywhere from 250 to 900 passengers will be flying aboard a single commercial airliner. These flying super buses will not set any speed records, but they will crack a formidable barrier to increased air travel—the price barrier. Fares on the new giants may be reduced from 10 to 20 percent. Thus, while the impressive supersonic transport will dominate commercial aviation news in the years to come (see *Supersonic Transport and You,* page 60) it is the flying bus, with its promise of economy transportation, that most people will be riding.

Giant military transport planes are already in the air and the 251-passenger Douglas DC 8-61 recently made its maiden flight. Boeing is already proudly displaying models of its planned 747 which will carry 490 passengers. Delivery of the 747 is scheduled by the end of 1969. And on the drawing board at Lockheed is the incredible, triple-deck, 902-seat C5A.

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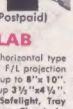

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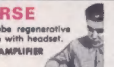

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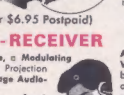
PHOTOMICROGRAPHY LAB

"Projection-type" Camera takes and prints pictures of subjects mounted on microscope slides. Enlarges up to 100 times. Takes the place of microscope, camera and printer. No other equipment needed. Includes: **Developing Trays, Chemicals, Paper, Microscope Slides and Safe Light.** Uses standard sizes of regular roll film.

(Available as a Separate Unit for $8.95 Postpaid)

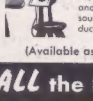
SLIDE PROJECTOR

Has interchangeable projection assemblies — one for standard 35MM slides, and the other, with greater magnification, for microscope slides. Comes with **140 watt GE Projection Lamp, Large Twin Condensing Lenses** for extra brightness, sturdy **Steel Housing** with inner chimney and baffle for cool operation.

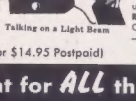


(Available as a Separate Unit for $6.95 Postpaid)

LIGHT TRANSMITTER-RECEIVER



The TRANSMITTER consists of a **Light Source, a Modulating Reflector Diaphragm** and an Optical Projection System. **The RECEIVER** is a **Two-Stage Audio-Amplifier,** controlled by a Photo-electronic Cell that catches the projected light beam and causes the original sound waves to be reproduced in the headphone.



Talking on a Light Beam

(Available as a Separate Unit for $14.95 Postpaid)

ATOMIC ENERGY LAB

ATOMIC CLOUD CHAMBER WITH PROJECTOR ILLUMINATOR. See the vapor trails of alpha and beta particles, and of cosmic rays.

SPINTHARISCOPE. Shows exploding atoms.

ELECTROSCOPE — metal housed with **Scale** and **Magnifying Viewer.** Measures background radiation and tests sample sources. **SAFE RADIOACTIVE MATERIALS.** Alpha Source in handy container and Uranium Ore.

Full instructions and explanations open up the fascinating field of nuclear physics.

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SPECTROSCOPE

Analyze spectra of glowing gases. See and identify the Fraunhofer Lines. A quality instrument featuring an **easy-to-read built-in scale and a powerful condensing system** for a bright spectrum. Equipment includes **Alcohol Burner** and a **2 Watt Neon Spectral Lamp. Full instructions cover theory and use.**

(Available as a Separate Unit for $5.95 Postpaid)

ULTRAVIOLET LAMP

140 watt filter type UV LAMP. Heavy metal cabinet. 6 Foot Cord, Rotary Switch. Produces dazzling color effects with invisible black light. Has many uses in the fields of Mineralogy, Crime Detection and Science. Accessories include **Invisible Ink, Tracer Powder, Fluorescent Crayons.**

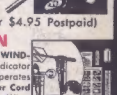
(Available as a Separate Unit for $6.95 Postpaid)

SURVEYOR'S TRANSIT

A practical Transit. 6X erect image telescope with Range Finder Reticle for measuring remote distances and heights. Vernier reading for both horizontal and vertical scales. Leveling Head with Thumb Screw Adjustment and Spirit Level. Clamps under head hold wooden legs of Tripod. (Legs not included.) **Instructions cover elementary surveying, range-finding.**

(Available as a Separate Unit for $5.95 Postpaid)

TELESCOPE AND MOUNT



30X erect image. Extends to 30" length. Five ground and polished Lenses. **Ramsden Eyepiece. Sturdy Equatorial Mount** makes it easy to follow the movement of heavenly bodies. Mount has fittings for wooden legs that complete the tripod (legs not included).

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A REMOTE READING ANEMOMETER AND WIND-VANE . . . Flashing Neon Lights on indoor indicator board show wind speed and direction. Operates on less than 1 **cent per month, Safety Power Cord** makes all connections safe. 100 ft. of Lead-In Wire. Plus — **Air Tank Barometer** with 4 ft. indicator column. **Sling Psychometer** measures relative humidity. **Rain Gauge** measures rainfall to 1/100 Level. ALSO Cloud Chart, Weather Map and Forecasting Manual — a complete set-up for amateur meteorology.

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